CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

MAY 15, 1943

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

10 12
Set at any desired control point
THROTTLING RANGE % OF REC. SCALE
RATE OF DROOP CORRECTION
Turn to any desired throttling range
Set any rate of automatic droop correction
Manual Control Knob
Switch
Throw switch for either automatic or manual control. Move knob to position valve manually. Knob indicates valve position.

Micromax is easily tuned to the furnace's needs—all settings are made at the front of the panel.

TO DEFEAT TEMPERATURE SWINGS MAKE MICROMAX PYROMETERS YOUR HELPERS

Every setting and resetting of its temperature controller which any standard type fuel-fired furnace could require is supplied with the Micromax Control equipment shown above.

We do not even have to know how much load-swing you anticipate, or how much lag; many users do send us such facts, but the Controller is completely adjustable to any such problem . . . the limits of satisfactory control, if there are limits, being determined by factors outside the Pyrometer.

Just tell us, when you specify Micromax, the make, size and type of valve; the fuel and air pressures; the type of thermocouple if you have preference; the range of temperature to be controlled; the amount of wire needed between couple, Micromax and valve; and whether you want to have the equipment mounted on panel as shown. The resulting installation will help you secure control of unsurpassed sensitivity, accuracy and dependability.

If a Catalog will answer your needs, ask for N-00A, Micromax Electric Control; our new, compact, fully-illustrated 30-page description of this equipment.

Jrl Ad N-33A(19a)

LEEDS & NORTHRUP COMPANY, 4990 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

TABLE OF CONTENTS

Volume 22 May 15, 1943 Number 5

CERAMIC ABSTRACTS Section

Abrasives 65
Art and Archeology 66
Cements 67
Enamel 67
Glass 69
Structural Clay Products 72
Refractories 72
Terra Cotta 76
Whiteware 76
Equipment and Apparatus 77
Kilns, Furnaces, Fuels, and Combustion 80
Geology 82
Chemistry and Physics 87
General 90

THE BULLETIN Section

Ceramic History

Development of the Tile Industry in the United States
By Everett Townsend 125–52

Editorial

A Free Industrial Enterprise Challenge—Will Ceramic Industries Be Prepared for Continuity of Change?
By G. H. McIntyre 153–55

Advertisers' Index **6**

Buyers' Guide **14, 18, 20, 23**

INDEX TO ACTIVITIES

American Ceramic Society, Fellows elected April 19, 1943, p. 158.

Ceramic Camera Club, Fifth Annual Salon award winners, p. 157.
Ceramic Society of the Southwest, March meeting, officers, p. 165.
Copper scrap, shortage in U. S., discussion, p. 164.

Electrochemical Society, new president, prize winners, p. 165.
Engineers' Council for Professional Development, tenth annual report, pp. 163–64.

Fellows. See *American Ceramic Society.*

Institute of Ceramic Engineers, letter to members (H. M. Kraner), pp. 160–61.
licensing efforts, p. 159.

Local Sections, Baltimore-Washington, April meeting, officers, p. 161.
Southern California, March meeting, officers, p. 161.

Members, membership workers' record, p. 157.
new, p. 157.
paid membership record, p. 156.
roster changes, p. 157.
Service Roster, p. 158.

Necrology, Ball, F. C., biog., p. 163.
Peck, A. B., biog., publications, photo, pp. 161–62.
Weigel, W. M., biog., photo, pp. 162–63.

Photographs, Ball, F. C., p. 163.
Peck, A. B., p. 162.
Schofield, H. Z., p. 158.
Weigel, W. M., p. 162.

Schofield, H. Z., joins Battelle Memorial Inst. staff, photo, p. 158.
Society of Glass Technology, appreciation of Turner portrait (resolutions), p. 158.
Spencer-Strong, G. H., appointed Pemco Research Director, p. 164.

Titanium Alloy Mfg. Co., issued order of secrecy, p. 165.

U. S. Bureau of Mines, Northwest electrodevelopment laboratory, site, p. 165.

Woman vs. man factory worker, strength ratios, p. 164.

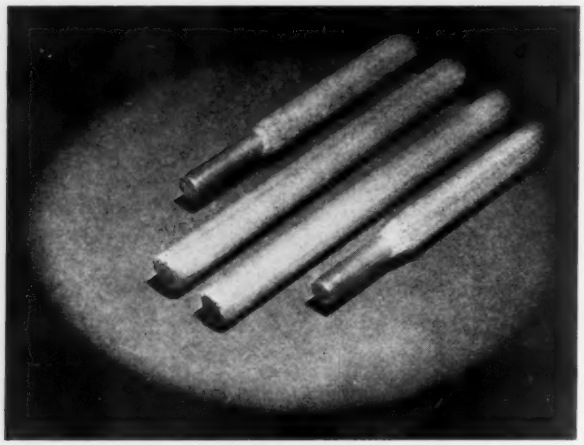
Publication Office: 20th & Northampton Sts., Easton, Pa.
Editorial, Executive, and Advertising Offices: 2525 N. High St., Columbus, Ohio.
Committee on Publications: J. D. SULLIVAN, *Chairman;* E. E. MARBAKER, J. B. AUSTIN, G. H. SPENCER-STRONG, ROSS C. PURDY.

Entered as second-class matter at the post office at Easton, Pa., under the act of March 3, 1879. Published monthly.
Subscription $1.50 a year. Single copies twenty-five cents.
(Foreign and Canadian postage, 50¢ additional on subscriptions)
(Copyright 1943, American Ceramic Society, Inc.)

Lancaster

THE SCIENTIFIC COUNTER-CURRENT RAPID BATCH MIXING SYSTEM

Lancaster Precision Promotes Uniform Mixing of Welding Electrode Coatings



Whether body formulas are of mineral or cellulose types, the balanced mixing-mulling action of "Lancaster" Mixers can be relied upon to promote thorough and uniform particle distribution in the mixing of welding electrode coatings.

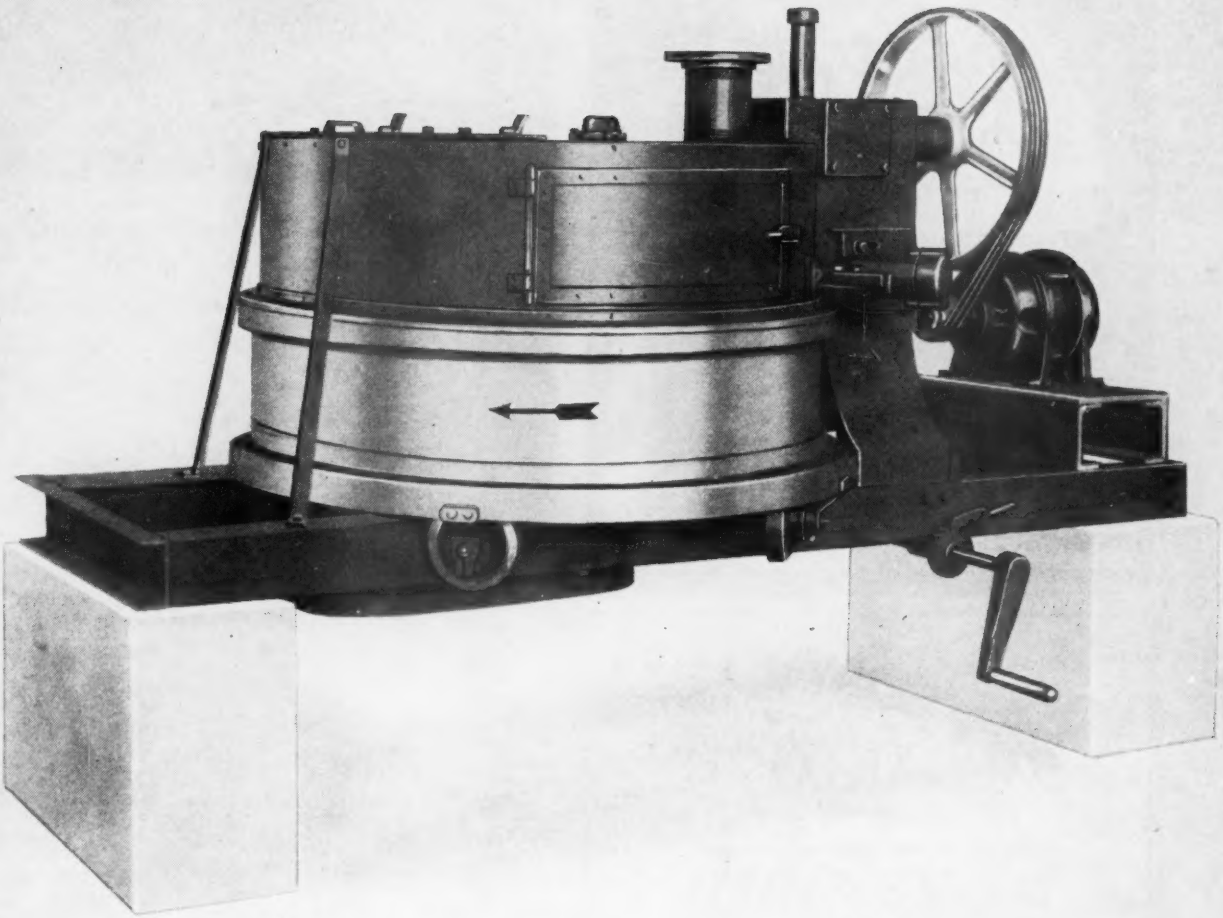
With the "Lancaster," the flux is completely mixed and conditioned properly for the slug press in lowest possible mixing time. The "Lancaster" counter-current mixing principle produces intensive activity in every part of the batch. Development of objectionable mechanical heat is minimized . . . hard spots in the finished coating are avoided.

The advantages of "Lancaster" Mixers with recommendations to suit your requirements will be submitted promptly, without obligation upon request—write today.

Check These Advantages of "Lancaster" Mixers

1. Regardless of variations in size . . . weight . . . or physical characteristics . . . particles are distributed with dependable uniformity.
2. Liquid additions are dispersed with startling perfection.
3. Rich or lean areas are avoided in the finished mix because no "dead spots" are established during the mixing action.
4. Development of mechanical heat is minimized.
5. Closed pan units provide excellent dust control facilities.

MIXERS



Symbol EBG-4 "Lancaster" Mixer, fully enclosed pan type, affording complete dust control of the batch at all times.

LANCASTER IRON WORKS, INC.

BRICK MACHINERY DIVISION

LANCASTER, PENNA., U. S. A.

HOMMEL

"World's Most Complete Ceramic Supplier"

FRIT

Colors & Oxides

Chemicals--Supplies

Equipment

THE

O. HOMMEL CO.

Quality First Since 1891

209 Fourth Avenue

PITTSBURGH, PA.

Pacific Coast Agents

L. H. BUTCHER CO.

Los Angeles, Salt Lake City, San Francisco, Portland, Seattle

FOR CLAY FILTRATION

use

METAKLOTH

(green)

Silvakloth

(black)

The oldest and best cupra-ammonium finish for

POTTERY FILTER FABRICS.

This finish gives the fabric a smooth, lustrous, metallic surface—no fibres to catch and break the clay cake as it comes away in one perfect piece—filters better and faster than untreated cloths—requires fewer washings and is easier to keep clean—more continuous operation of your press—lower labor costs and a larger and better product with the same machinery.

The fabric is mildew proofed—has an increased tensile strength—has a longer useful life.

This means larger profits for you.

Consult your bag manufacturer or write to,

Metakloth Company, Lodi, N. J.

WHEN a Solvay Technical Service man receives an invitation from you, perhaps so that you may obtain an outside viewpoint on a problem which has proven particularly difficult to solve, it is sometimes necessary to supply him with information of a confidential nature.

... That is a point on which some manufacturers might hesitate to avail themselves of Solvay Technical Service. Please be assured that any information that you may impart to a Solvay Technical Service man remains in strictest confidence. It is used only insofar as it is necessary to help solve your particular problem. When consultations are concluded, your problem is a closed book with Solvay Technical Service.

You will find on the staff of Solvay Technical Service men of the highest type who have been especially trained to cope with your problems as they relate to alkalies. They are at your service. Please feel free to call on them without hesitation.

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 RECTOR STREET **NEW YORK, N. Y.**

SOLVAY

TRADE MARK REG. U. S. PAT. OFF.

TECHNICAL SERVICE

SUPER REFRACTORIES BY CARBORUNDUM

INCREASE PRODUCTION, CUT MAINTENANCE COSTS, REDUCE OPERATING COSTS, INCREASE EFFICIENCY

In applications like these . . .

Aluminum Melting Furnaces	Ceramic Kilns	Lime Kilns	Reheating Furnaces
Annealing Furnaces	Chemical Process Furnaces	Magnesium Melting Furnaces	Rotary Kilns
Boiler Settings	Electric Furnaces	Muffle Furnaces	Tunnel Kilns
Brass Melting Furnaces	Heat Treating Furnaces	Muffle Roasters	Water Gas Sets
By-Product Coke Ovens	Hydrocarbon Cracking Regenerators	Muriatic Acid Furnaces	Zinc Refining
Carburizing Furnaces		Oil Refining Stills	Zinc Retorts

THE chart below gives you a quick summary of the characteristics of five super refractories by Carborundum which are doing a big job on the war production front. Each of these super refractories is made in many modified compositions providing a wide range of physical properties.

Please remember that our entire current production is going to war industries.

CARBOFRAX
1. Heat Conductivity, 109 Btu.
2. Refractoriness, PCE Cone 37-40
3. High Spalling Resistance
4. High Abrasion Resistance
5. Low Thermal Expansion
6. Specific Heat, 0.285
7. Weight, 9-in. Straight, 9.25 lb.

MULLFRAX
1. Heat Conductivity, 15 Btu.
2. Refractoriness, PCE Cone 38-39
3. High Spalling Resistance
4. Medium Abrasion Resistance
5. Medium Thermal Expansion
6. Weight, 9-in. Straight, 9.5 lb.

ALFRAX BI
1. Heat Conductivity, 7 Btu.
2. Refractoriness, PCE Cone 38
3. Good Spalling Resistance
4. Low Abrasion Resistance
5. Medium Thermal Expansion
6. Specific Heat, 0.320
7. Weight, 9-in. Straight, 4.5 lb.

ALFRAX K
1. Heat Conductivity, 21 Btu.
2. Refractoriness, PCE Cone 37-39
3. Medium Spalling Resistance
4. High Abrasion Resistance
5. Medium Thermal Expansion
6. Specific Heat, 0.330
7. Weight, 9-in. Straight, 10.1 lb.

MULLFRAX S
1. Heat Conductivity, 7 Btu.
2. Refractoriness, PCE Cone 37-38
3. High Spalling Resistance
4. Medium Abrasion Resistance
5. Medium Thermal Expansion
6. Weight, 9-in. Straight, 7.8 lb.

REFRACTORY CARBORUNDUM PRODUCTS

Refractory Division **THE CARBORUNDUM COMPANY,** *Perth Amboy, N. J.*

REG. U. S. PAT. OFF.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum, Carbofrax, Alfrax and Mullfrax are registered trade-marks of and indicate manufacture by The Carborundum Company)

ALPHABETICAL LIST OF ADVERTISERS

	Page
American Potash & Chemical Corporation	8
American Telephone & Telegraph	24
Buyers' Guide	14, 18, 20, 23
Carborundum Co.	5
Classified Ads	6, 8, 10
Clearfield Machine Co.	10
Corhart Refractories Company, Inc.	12
Du Pont, E. I., de Nemours, & Co., Inc.	21
Fate-Root Heath Co.	15
Felker Mfg. Co.	7
Frazier-Simplex, Inc.	13
Hammill & Gillespie, Inc.	10
Hommel, O., Company	4
Industrial Ceramic Products, Inc.	8
International Pulp Co.	6
Kentucky Clay Mining Co.	*94
Lancaster Iron Works, Inc.	2–3
Leeds & Northrup	Inside Front Cover
Maxson, Elwyn L.	19
McDanel Refractory Porcelain Company	8
Metakloth Co.	4
Metal & Thermit Corp.	Outside Back Cover
National Engineering Co.	9
Norton Company	16–17
Pacific Coast Borax Company	22
Porcelain Enamel & Mfg. Company	8
Potters Supply Company	22
Proctor & Schwartz, Inc.	8
Professional Directory	19
Solvay Sales Corporation	4
Spinks, H. C., Clay Company	Inside Back Cover
Stauffer Chemical Co.	†164
Swindell-Dressler Corp.	19
Titanium Alloy Mfg. Co.	11
Vitro Mfg. Company	6
Wilson, H. W., Company	22

* In Abstract Section

† In Editorial Section.

CERAMITALC

Registered in U. S. Patent Office

For—WALL TILE
DINNERWARE and
REFRACTORY BODIES

LIBERAL SAMPLES FREE

INTERNATIONAL PULP CO.
41 PARK ROW NEW YORK

FOR SALE

Journals and Bulletins of The American Ceramic Society, 1926 to present. Some issues are missing; best offer takes them. Box 225 F, The American Ceramic Society, Inc., 2525 N. High St., Columbus, Ohio

QUALITY COLORS for QUALITY WARE

Whether your requirements are large or small, we take the same painstaking care to serve you promptly and efficiently. Write us on any problem involving ceramic color.

★ Overglaze Colors ★ Vitreous Colors ★

★ Acid Resistant Colors ★ Oxide Colors ★

COLORS — CHEMICALS — SPECIALTIES

THE VITRO MANUFACTURING CO.
CORLISS STATION PITTSBURGH, PA.
16 California St., San Francisco, Calif.

CUTTING TRANSITE

... at high speed

Transite, a material composed of cement and asbestos, is commonly used in various forms where heat, corrosion, rust or fire must be guarded against. Abrasion during cutting operations is severe and in the past has been a tedious, time-consuming operation.

But cutting Transite proves a brilliant application for DI-MET Rimlock diamond abrasive wheels. Now, a portable, motor-driven saw equipped with an 8" Di-Met Rimlock slices 24" diameter Transite pipes of 2" wall thickness in only 35 minutes . . . an increase in speed of 600 to 800% over former methods! The Rimlock is water-lubricated during operation and produces a clean, straight surface.

DI-MET Rimlock blades are highly efficient for cutting all dense, brittle, non-metallic materials — even those of extreme hardness. The unique bonding method between diamonds and matrix gives increased blade life and fast cutting speed. Applications can be successfully made to Glass, Quartz, Steatite, Vitreous Products, Ceramics, Porcelain, Tile, Glazed Face Brick, etc.

DI-MET blades are available in two bonds, copper and steel, in even diameters from 4" to 24". A 3" size is the smallest regularly made.

DI-MET Rimlocks

FOR SPEED • FOR ACCURACY • FOR LONG LIFE

FELKER MANUFACTURING CO.

1111 Border Avenue **Torrance, Calif.**

MANUFACTURERS OF DIAMOND ABRASIVE WHEELS

McDANEL REFRACTORY PORCELAIN COMPANY
Manufacturers of
PYROMETER TUBES AND INSULATORS
COMBUSTION TUBES AND BOATS
GAS ANALYSIS TUBES
LABORATORY GRINDING JARS
PORCELAIN MILL LININGS
PORCELAIN GRINDING BALLS
BEAVER FALLS PENNSYLVANIA

THREE ELEPHANT
BORAX
REG. U.S. PAT. OFF. REG. U.S. PAT. OFF.
AND BORIC ACID
GUARANTEED OVER 99.5% PURE
AMERICAN POTASH & CHEMICAL CORPORATION
122 E. 42nd Street, New York

INDUSTRIAL CERAMIC PRODUCTS, Inc.
MANUFACTURERS
PINS CONE PLAQUES STILTS
COLUMBUS, OHIO

Tunnel, Truck and Humidity Dryers
for—
Dry Pressed Electrical Porcelain
High Voltage Electrical Porcelain
Sanitary Porcelain
Floor Wall Tile
Abrasive Wheels
Glass Pots and Blocks
Refractory Bricks and Shapes
Also Stove Rooms and Mangles for General Dinnerware
PROCTOR & SCHWARTZ, INC.
The Largest Builders of Drying Machinery for Industry
Seventh Street & Tabor Road, Philadelphia, Pa.

WANTED—MACHINIST-DESIGNER
To take full responsibility design, construction, new machine processes. Must be top-rate man; experienced automatic glass processing equipment. Good steady job with future. Advertiser presently 100% War production. Give full particulars including experience, references, salary desired. State draft status. Location small residential town, western New York. Box 223F, The American Ceramic Society, 2525 N. High St., Columbus, Ohio.

WANTED
Mechanical engineer for designing, building and improving glass house machinery in semiautomatic plant. Exceptional opportunity. Satisfactory salary. State experience, references and draft status in application. Address Box 224 F.
The American Ceramic Society, Inc.,
2525 N. High St., Columbus, Ohio

STEATITE

another example of the advantages of SIMPSON Controlled MIXING

. . . "Our Simpson Mixer has played a very vital role in our conversion from special porcelain to Steatite porcelain" . . .

THE LOUTHAN MANUFACTURING CO.
MANUFACTURERS OF
ELECTITE
EAST LIVERPOOL, OHIO
January 28, 1943

National Engineering Co.,
549 W. Washington Blvd.,
Chicago, Ill.

Gentlemen:-

We are taking this opportunity to advise you of the fine performance and low maintenance cost of our #2 Simpson Mixer.

This mixer has been in operation for three years and the only part we have had to replace is one set of plows at a cost of $34.00 plus a few hours installation time. [illegible] and the bed plate are good for at least three more years of service.

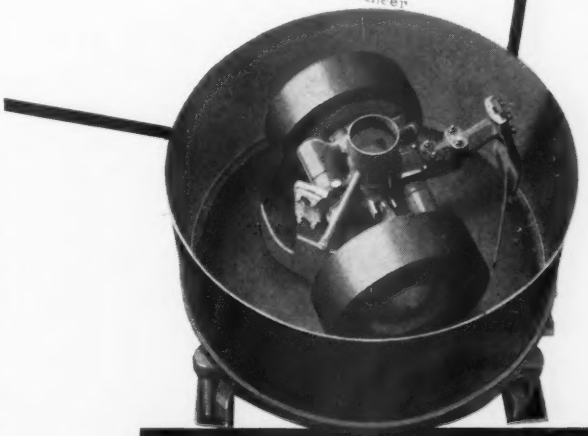
Our Simpson Mixer has played a very vital role in our conversion from special porcelain to Steatite porcelain, which is used in Radio Communication equipment for the Armed Forces.

Very truly yours,
THE LOUTHAN MFG. COMPANY
C. W. Gerster
Cer. Engineer

LOUTHAN Manufacturing Co. produces quality porcelain products—among them is Steatite. Positive, controlled mixing in preparing ceramic bodies is an acknowledged vital factor in Louthan's production program. Read the comments in their letter.

Simpson "Controlled Mixing" has proved, again and again, that its principle of mulling assures the maximum of thorough uniform mixing; it develops the greatest plasticity of the materials; requires less floor space, lower horsepower; allows higher man-hour production, *all in greatly reduced mixing time.* Those are proved advantages!

Why don't you talk your problems over with a National Ceramic Engineer — you can certainly profit by it. No obligation of course. There is a catalog to give you all the details . . . write for it.



SIMPSON *Intensive* MIXERS for Controlled Mixing of Ceramic Bodies . . . BETTER — FASTER at LESS COST

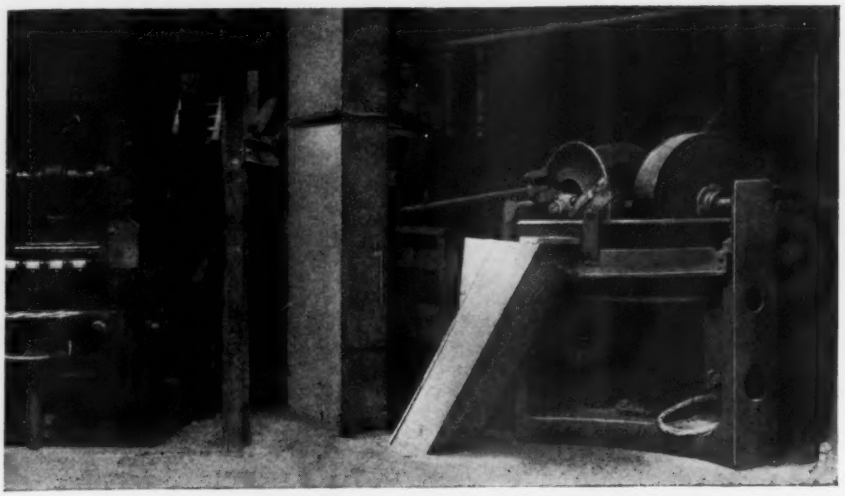
SIMPSON

INTENSIVE MIXERS Built in 10 Sizes

NATIONAL ENGINEERING COMPANY

MACHINERY HALL BUILDING • CHICAGO, ILLINOIS

Manufacturers and Selling Agents for Continental European Countries:—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia — August's Limited, Halifax, England. For Canada — Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand — Gibson, Battle & Co., Pty., Ltd. Sydney, Australia



Clearfield 610 Mixer preparing dry press refractories.

The
CLEARFIELD
(muller type) Mixer is the most efficient means of blending and tempering various raw materials used in the ceramic and allied industries.

We shall be glad to furnish information if advised of your requirements.

CLEARFIELD MACHINE COMPANY
Clearfield, Penna.

CLAYS
English China and Ball
— —
TALCS
for
HEATING ELEMENTS
CERAMIC BODIES
SAGGER USES
— —
Ceramic Specialties Include
Whiting : Paris White : Magnesite
Cornwall Stone : Barium Carbonate
Zinc Oxide : Enameling Clays : Etc.

HAMMILL & GILLESPIE, INC.
Importers since 1848
225 Broadway New York

POSITION WANTED

Ceramic Engineer desires position in war work where best use can be made of the training and experience in research, control, and production of steatite, condensers, high and low dielectrics, spark plugs, textile guides, dinnerware, and limited sanitaryware and refractories. Ideas available on war products development in the above fields and research problems for postwar products. Deferment required. Address Box 221F, The American Ceramic Society, 2525 N. High St., Columbus, Ohio.

GLASS TECHNOLOGIST

Wanted by Midwest research organization. Experience or graduate training in glass technology necessary. Write giving draft status and full details of training and experience. Address Box 222F, The American Ceramic Society, 2525 N. High St., Columbus, Ohio.

MANUFACTURERS:

CONSERVE TIN AND ANTIMONY FOR WAR WORK

HOW ZIRCON FRITS* AND TAM ZIRCONIUM OPACIFIERS SAVE TWO VITAL METALS

The increasing need for Tin and Antimony in defense manufacturing has emphasized the possibilities of the wider use of Zircon Frits and TAM Zirconium Opacifiers in Ceramic Ware, Vitreous Enamel Ware, Brick and Tile products. Many manufacturers, who are helping to conserve Tin and Antimony, report that Zircon Frits and TAM Zirconium Opacifiers are not only easy to use and economical, but improve the products. A TAM field-trained Ceramic Engineer is available, without obligation, for consultation. Write:

TITANIUM
ALLOY MANUFACTURING COMPANY

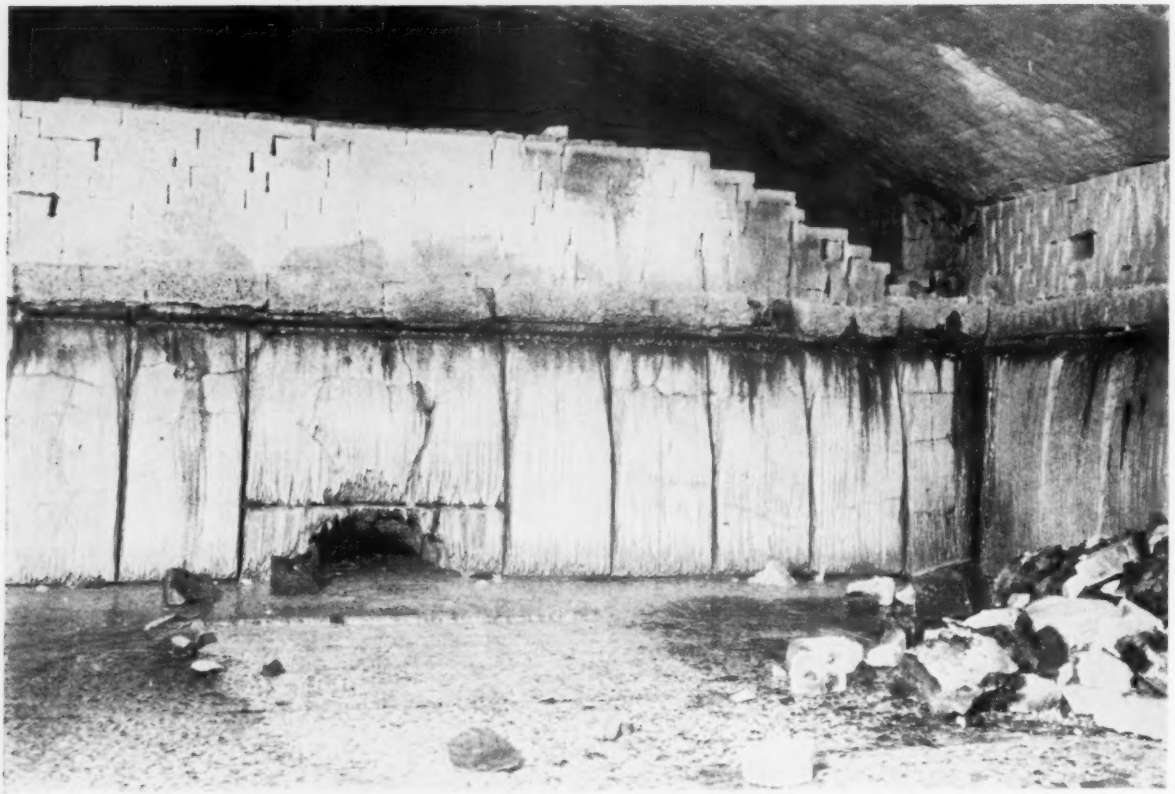
TAM
ZIRCONIUM TITANIUM
PRODUCTS
Registered U. S. Pat. Off.

GENERAL OFFICES AND WORKS: NIAGARA FALLS, N. Y., U. S. A.
EXECUTIVE OFFICES: 111 BROADWAY, NEW YORK CITY

Representatives for the Pacific Coast States . . . . L. H. BUTCHER COMPANY, Los Angeles, San Francisco, Portland, Seattle

Representatives for Europe . . UNION OXIDE & CHEMICAL CO., Ltd., Plantation House, Fenchurch St., London, E. C., Eng.

* *"The Porcelain Enamel & Mfg. Co., Baltimore, Maryland; Chicago Vitreous Enamel Product Co., Cicero, Illinois; Ingram-Richardson Mfg. Co. of Indiana, Inc., Frankfort, Indiana; and American Porcelain Enamel Co., Muskegon, Michigan are licensed under U. S. Patents No. 1,848,567 and 1,944,938 held by the Titanium Alloy Manufacturing Company, and other patents pending, for the manufacture of zircon type enamel frits."*



Electrocast Blocks Still Good After 984 Days!

HERE is a performance story for a Corhart* Electrocast balanced unit—a story that is not only good but typical.

The life and production figures provoke and merit interest. Here they are—compare the last item with your own statistics.

Fire 1940—1942	
TOTAL DAYS LIFE	984 days
OPERATING DAYS	964 days
IDLE DAYS	20 days
TOTAL TONS GLASS PRODUCED	82,582
TONS GLASS PRODUCED PER OPERATING DAY	85.66
SQUARE FEET OF MELTING AREA PER TON GLASS PER OPERATING DAY	5.88
TONS OF GLASS PER SQUARE FOOT MELTING AREA PER LIFE	163.73

The glass melted throughout the campaign was a standard clear flint bottle glass.

The furnace did not fail, but was shut down at the proper seasonal point for most advantageous repairing.

Or, as our customer himself wrote us, ". . . when we were able to get into this furnace we found that the Corhart blocks were all in very good condition and we believe that we could have gotten at least six more months from this furnace which would have made the furnace run for over three years. This is what we are aiming for when we place the furnace into production again. . . ."

That's the story—a long successful life summarized in a few words.

Corhart Refractories Co., Incorporated, 16th and Lee Streets, Louisville, Kentucky.

*Not a product, but a registered trade-mark.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

Ceramic Abstracts Section

Compiled by

THE AMERICAN CERAMIC SOCIETY

ABSTRACTERS

A. A. Ayars	W. D. Foster	R. A. Heindl	B. B. Lane	Alexis Pincus	Stanford Setchell
L. R. Barrett	V. D. Fréchette	W. H. Herschel	M.-C. Ling	M. E. Poor	N. R. Sewell
A. C. Bevan	R. L. Green	M. Hoseh	E. D. Maher	Katherine Reed	Lucille Shattuck
R. H. Bollinger	R. A. Gregory	F. J. Hurlbut	E. H. McClelland	H. K. Richardson	H. E. Simpson
M. V. Condoide	Max Hartenheim	G. M. Hutt	J. G. Phillips	B. C. Ruprecht	L. E. Thiess
P. S. Dear	F. G. Heck	G. A. Kirkendale	E. C. Pierce	A. B. Searle	Hans Thurnauer

JOURNAL REFERENCE: The journal name appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 22 **May 15, 1943** **No. 5**

Abrasives

Abrasive industry makes efficient use of equipment. ANON. *Brick & Clay Record*, **102** [1] 48–50, 52 (1943).—The manufacture of abrasive wheels is described. B.C.R.

Abrasives. ANON. *Mineral Ind.*, **50**, 1–4 (1941).—Statistics on prices, production, and uses of abrasives for 1941 are given. B.C.R.

Carborundum abrasive wheels. ANON. *Machinery* [N. Y.], **49** [3] 250 (1942).—A new line of abrasive wheels (designated MX) for use without coolant on any type of flexible-shaft machine or hand grinder has been brought out by the Carborundum Co. The MX wheels are made up of thin disks of cotton fibers impregnated or mixed either with Aloxite brand aluminum oxide or Carborundum brand silicon carbide. The thin disks are bonded together or are built up in the form of resilient and flexible wheels. R.H.B.

Covel universal cutter and tool grinder. ANON. *Machinery* [N. Y.], **49** [4] 218 (1942).—Flexibility, speed, and adaptability for a wide range of operations are outstanding features of the No. 22 universal cutter and tool grinder developed by the Covel Mfg. Co., Benton Harbor, Mich. R.H.B.

Double-end carbide-tool grinder. ANON. *Machinery* [N. Y.], **49** [3] 254 (1942).—The machine is fitted for efficient freehand grinding of tungsten carbide tipped tools and other tool bits. R.H.B.

Fitchburg adjustable angular-head grinding machine. ANON. *Machinery* [N. Y.], **49** [3] 244 (1942).—The machine is designed to handle a wide range of cylindrical grinding work. R.H.B.

Foster general-purpose superfinishing machines for cylindrical work. ANON. *Machinery* [N. Y.], **49** [3] 234 (1942).—The improved superfinishing machine for cylindrical work built by the Foster Division of the International Machine Tool Corp. is capable of developing accurate and fine finishes of 2 to 5 micro-in. on shafts and tool parts. R.H.B.

Gamal—new polishing material for the metallographer. ANON. *Laboratory*, **13** [5] 120–22 (1942).—Gamal is the trademark for a polishing material made from γ-alumina. It is hard, brittle, and platelike. When used, it breaks down under pressure to form cubes as small as 1.5 microns in size and possibly smaller. It is used with a cloth on which the pile is deposited electrostatically. W.D.F.

Hammond cylindrical polishing machine. ANON. *Machinery* [N. Y.], **49** [3] 238 (1942).—The cylindrical finishing machine may be used in production lines on parts such as universal parts, condenser tubing, and steel tubing. It will handle parts having an outside diameter of $^1/_4$ to 9 in. R.H.B.

Norton Co. offers motion picture lessons in grinding. ANON. *Machinery* [N. Y.], **49** [4] 181 (1942).—To aid training courses in the war industries, Norton Co., Worcester, Mass., has available motion pictures entitled "Lessons in Grinding." The series deals with (1) cutter sharpening, (2) the cylindrical grinder, (3) the surface grinder, and (4) the grinding wheel—its care and use. R.H.B.

Reclaiming abrasive grain. J. ALEXANDER. *Amer. Machinist*, **86** [23] 1345–46 (1942).—A study made to determine whether abrasive grain can be economically reclaimed from polishing refuse showed conclusively that (1) abrasive grain so reclaimed is practically as good as new grain and (2) the cost of reclaiming is less than a quarter of the price of new grain. The polishing refuse is passed through a revolving barrel furnace where all glue adhering to the grain is burned off and most of the other dirt is reduced to a fine dust. This mass is then passed under a magnet on its way to the screens, and all magnetic metallic particles are removed. Grit size No. 80 is the finest for practical use that can be obtained by screening through wire sieves. The reclaimed grain is mixed with an equal amount of new grain in preparing abrasive stock for polishing wheels. M.HA.

BOOK

Abrasive Grains and Their Uses. JOHNSON HEYWOOD. Published under the auspices of the Abrasive Grain Assn. Penton Publishing Co., Cleveland, 1943. 72 pp., 39 illustrations. Price $1.00.—H. describes the methods of using abrasive grains for various purposes: polishing, flexible grinding, and buffing; lapping; optical glass; and miscellaneous uses. A glossary of trade names and an index are included.

PATENTS

Abrading tool. J. C. GARAND. U. S. 2,314,348, March 23, 1943 (Jan. 23, 1942).

Abrasive-article manufacture. J. S. SMYSER (Minnesota Mining & Mfg. Co.). Can. 409,545, Dec. 22, 1942 (Dec. 29, 1932). G.M.H.

Abrasive grain. A. A. KLEIN (Norton Co.). Can. 410,195, Jan. 26, 1943 (May 31, 1941; in U. S. June 26, 1940). G.M.H.

Automatic grinder. C. B. DE VLIEG (Le Maire Tool & Mfg. Co.). U. S. 2,314,483, March 23, 1943 (Feb. 6, 1941).

Blade making and resharpening machine. H. C. SIMMONS. U. S. 2,312,270, Feb. 23, 1943 (Aug. 5, 1940).

Boron carbide composition. J. A. BOYER AND C. G. ROSE (Carborundum Co.). Can. 409,935, Jan. 12, 1943 (March 6, 1936; Aug. 8, 1941). G.M.H.

Bracket for grinding wheels. BOGOIA STREZOFF. U. S. 2,311,582, Feb. 16, 1943 (Jan. 22, 1942).

Coated abrasive. N. E. OGLESBY (Durex Corp.). Can. 410,093, Jan. 19, 1943 (Nov. 17, 1941). G.M.H.

Coating granular materials and product thereof. J. A. BROWN AND J. E. CLARKE (Minnesota Mining & Mfg. Co.). U. S. 2,314,340, March 23, 1943 (July 13, 1940).

Dressing device for grinding wheels. GILBERT STEWART (Ex-Cell-O Corp.). U. S. 2,311,263, Feb. 16, 1943 (Oct. 17, 1940).

Dressing mechanism. A. L. STEWART (Gleason Works). U. S. 2,311,262, Feb. 16, 1943 (June 3, 1940). ERNEST WILDHABER AND L. O. CARLSEN (Gleason Works). U. S. 2,311,302, Feb. 16, 1943 (Nov. 13, 1939).

Drill-grinding device. V. N. HOERST. U. S. 2,313,641, March 9, 1943 (April 9, 1941).

Duplex lapping machine. H. S. INDGE (Norton Co.). U. S. 2,311,185, Feb. 16, 1943 (May 29, 1941).

Expansible hone. D. A. WALLACE (Chrysler Corp.). U. S. 2,312,011, Feb. 23, 1943 (March 31, 1939). U. S. 2,312,012, Feb. 23, 1943 (Aug. 26, 1940). U. S. 2,312,013, Feb. 23, 1943 (March 31, 1939; Oct. 25, 1940).

Grinding or abrading machines. A. A. JONES & SHIPMAN, LTD., AND J. HOULDSWORTH. Brit. 549,936, Dec. 31, 1942 (July 12, 1941).

Grinding and/or lapping machines. P. G. THOMAS. Brit. 551,054, Feb. 17, 1943 (Sept. 27, 1941).

Grinding machine. R. H. CRAMER (General Motors Corp.). U. S. 2,311,213, Feb. 16, 1943 (July 30, 1940). G. C. HUNT. U. S. 2,314,787, March 23, 1943 (Dec. 6, 1941). NORTON CO. Brit. 550,601, Jan. 27, 1943 (Oct. 26, 1940).

Grinding material. C. H. COMMONS, JR. (Titanium Alloy Mfg. Co.). Can. 410,132, Jan. 19, 1943 (Oct. 4, 1941; in U. S. Oct. 11, 1940). G.M.H.

Grinding method and apparatus. W. C. KNAPP (Mattison Machine Works). U. S. 2,314,312, March 16, 1943 (April 10, 1941).

Grinding-tool dresser. G. A. DE VLIEG. U. S. 2,313,055, March 9, 1943 (Aug. 2, 1940).

Grinding wheel or other abrasive article. NORTON GRINDING WHEEL CO., LTD. Brit. 550,806, Feb. 10, 1943 (Dec. 24, 1940).

Honing machine. C. A. FULMER. U. S. 2,312,540, March 2, 1943 (Jan. 29, 1942).

Honing tool. J. E. KLINE (Micromatic Hone Corp.). U. S. 2,313,442, March 9, 1943 (Feb. 23, 1939).

Lapping apparatus. D. A. WALLACE (Chrysler Corp.). U. S. 2,312,014, Feb. 23, 1943 (Nov. 7, 1941).

Lapping process. D. A. WALLACE (Chrysler Corp.). U. S. 2,314,533, March 23, 1943 (July 17, 1941).

Method and device for grinding cooperating faces of friction members. JEAN COTAL (vested in the Alien Property Custodian). U. S. 2,313,804, March 16, 1943 (May 31, 1940).

Multiple wheel grinding machine. H. N. ROCKS, M. A. HOLLENGREEN, AND H. E. BALSIGER (Landis Tool Co.). U. S. 2,313,482, March 9, 1943 (June 6, 1940).

Polishing machine. L. H. STERNE AND W. N. LURCOTT (L. H. Sterne). U. S. 2,313,781, March 16, 1943 (Nov. 18, 1941).

Roll-grinding machine. JOSEPH HARTMAN (Lobdell Car Wheel Co.). U. S. 2,312,161, Feb. 23, 1943 (Sept. 30, 1941).

Soft-bond article. R. S. DANIELS (Bakelite Corp.). U. S. 2,312,392, March 2, 1943 (May 18, 1940).—Method of preparing an abrasive article of the soft-bond type from granules having as a bond a phenolic resin which comprises mixing the granules with a phenolic novolac resin together with a hardening agent selected from the group consisting of hexamethylenetetramine, high formaldehyde phenolic resin, and compounds containing the azomethine group and polymers thereof, the hardening agent being present in an amount to yield available methylene equivalent to about 3 to 6% of hexamethylenetetramine based on the weight of the novolac resin, molding the mixture, and firing the molded article to a state characterized by a softening of the bond that becomes crumbly without fusion under grinding pressure at temperatures approximating 100°C. or higher.

Valve-seat grinder. W. K. BECKWITH (Milwaukee Electric Tool Corp.). U. S. 2,314,028, March 16, 1943 (March 17, 1941).

Art and Archeology

Ceramic sculpture. PAUL BOGATAY. *Bull. Amer. Ceram. Soc.*, **22** [3] 66–67 (1943).

Albert Champion. ANON. *Bull. Amer. Ceram. Soc.*, **22** [3] 56 (1943).

Cranbrook Academy of Art. ANON. *Studio* [London], **124** [596] 159–61 (1942).—The Cranbrook Academy, Bloomfield Hills, Detroit, begun in 1904, grew into the Cranbrook Foundation (1927) for the study of architecture, civic design, sculpture, painting, weaving, and ceramics. Examples of ceramic and other work are illustrated. L.R.B.

Designing pays dividends. D. L. HADLEY. *Ceram. Forum*, **6** [3] 4 (1940).—The benefits of industrial design in porcelain enamel as used in the electrical industry are pointed out. The advantages and improvements of the streamline iron, rectangular roaster, and electric range are mentioned as examples. A knowledge of materials and manufacturing processes is essential for best results as well as the full cooperation of the engineering and production departments. H.E.S.

Fifty golden years in the pottery industry. LUCILLE COX. *Ceram. Forum*, **7** [2–3] 2, 3, 6, 12 (1941).—A historical sketch of the pottery industry in America for the past fifty years is given. The logical growth and gradual development are traced to the present-day industry involving the scientist, engineer, research artist, sales manager, traffic manager, superintendent, and foremen, as well as fifteen thousand potters, men and women. Illustrated. H.E.S.

History of fifty years in the glass industry. E. WARD TILLOTSON. *Ceram. Forum*, **7** [2–3] 7, 10 (1941).—A historical review of the glass industry for the past fifty years is presented. T. traces mechanical developments, chemical progress, glass product developments, and research. Statistics are also presented showing the phenomenal change in the number of establishments, valuations, and products during the period. H.E.S.

Lotus ware, a contribution to information on this ware. ARTHUR S. WATTS. *Bull. Amer. Ceram. Soc.*, **22** [3] 56–57 (1943).

Modeling sheet glass in a pottery kiln. DOLLY M. ERNST. *Bull. Amer. Ceram. Soc.*, **22** [3] 64 (1943).

Nizamabad pottery. S. S. DAS. *Trans. Indian Ceram. Soc.*, **1** [2] 112–22 (1942).—The history and the process of

manufacture of the pottery are described. Defects of the ware are listed. Precautions and suggestions are advanced for the improvement of the ware. P.S.D.

Pre-Ming ware of China. A. L. HETHERINGTON. *Trans. Brit. Ceram. Soc.*, **41** [11] 257–67 (1942). R.A.H.

J. C. Steele & Sons. ANON. *Bull. Amer. Ceram. Soc.*, **22** [4] 109–10 (1943).—3 photographs.

Trials on ceramic stains—blacks. S. JAGADISHAN AND H. N. BOSE. *Trans. Indian Ceram. Soc.*, **1** [2] 91–93 (1942).—Thirty-two combinations of iron chromate, cobalt oxide, and manganese dioxide were calcined at 1200°C., pulverized, washed, and tried as overglaze and underglaze colors. The following combinations gave the best results:

	No. 20	No. 21	No. 22	No. 23
Iron chromate	75	70	70	70
Cobalt oxide		25	20	15
Manganese dioxide	25	5	10	15

These stains are quite suitable for earthenware and stoneware, but not for high-temperature porcelains. P.S.D.

PATENTS

Decoration of vitreous articles. H. F. SCHEETZ, JR. (Fuller Label & Box Co.). U. S. 2,311,876, Feb. 23, 1943 (Dec. 5, 1939).—A transfer medium for decorating vitreous objects comprising a thin self-sustaining plastic film destructible at a temperature below the fusing temperature of the surface of the object to be ornamented which carries an opaque ceramic color that will readily fuse to the object to be decorated and which is deposited on the object when the film is destroyed, the film also having applied thereto outermost on its surface a decoration composed of a ceramic material that will also readily fuse to the object to be decorated and which will be deposited on the object over the opaque material, and a coating of adhesive on the side of the film opposite the design, the adhesive being normally exposed and forming an original surface of the label so that it may be wet in a labeling machine and applied directly to the ware.

Designs for:

Ash tray. C. T. SLOAN (Jeannette Glass Co.). U. S 134,997, Feb. 9, 1943 (Jan. 1, 1943).

Bottle stopper. J. J. MORAN (Kimble Glass Co.). U. S. 135,105, Feb. 23, 1943 (Oct. 31, 1941).

Building block. W. A. LARSON. U. S. 135,257, March 16, 1943 (Nov. 18, 1942).

Ceramic brooch pin. ELLIOT HANDLER. U. S. 135,096 and U. S. 135,100 to 135,103, Feb. 23, 1943 (Jan. 21, 1943).

Dish. A. L. HARSHMAN (Indiana Glass Co.). U. S. 135,030, Feb. 16, 1943 (Dec. 13, 1941).

Cements

Composition and physical properties of aqueous extracts from Portland cement clinker pastes containing added materials. GEORGE L. KALOUSEK, C. H. JUMPER, AND J. J. TREGONING. *Jour. Research Nat. Bur. Standards*, **30** [3] 215–55 (1943); RP 1530. Price 10¢.—Mixtures of 12 commercial Portland cement clinkers and water were filtered at 7 min. and at 2 hr. after mixing, and the chemical composition, pH, conductivity, surface tension, and density of the extracts were determined. The effects on the composition and physical properties of the extracts produced by the addition of small amounts of various materials to the pastes were studied in parallel experiments. The added materials included gypsum, which was used in preparing the cements from the clinkers, calcium chloride, calcium acetate, fluosilicic acid, sucrose, T D A, tannic acid, and triethanolamine. In the majority of the extracts, soda and potash were present in greater amounts than any of the other dissolved oxides. Relatively high concentrations of sulfate occurred in the extracts of clinkers that contained the larger amounts of potash. The lime concentration and basicity of the extracts were largely determined by the amounts of alkali oxides present. The concentration of silica corresponded approximately to the reported solubility of silica in lime solutions. Low concentrations of the oxides of the R_2O_3 group were found, except in extracts from pastes containing added organic materials. See "Potassium. . .," *Ceram. Abs.*, **20** [11] 259 (1941). R.A.H.

Effect of admixtures on Portland cement. CHARLES H. JUMPER AND GEORGE L. KALOUSEK. *Rock Products*, **45** [6] 58–59; [7] 64–65 (1942).—Cupric chloride, manganous sulfate, magnesium fluosilicate, and fluosilicic acid, in general, markedly increased the 1-hr. temperature rise and delayed the time required to reach the maximum temperature rise as well as the final set. Sucrose caused an increase in the 1-hr. temperature rise and induced both retardation and acceleration of time of set among clinkers. Triethanolamine and its chloride and sulfate salts behaved as vigorous accelerators of both the set and the thermal changes. See *Ceram. Abs.*, **21** [8] 164 (1942). B.C.R.

Enamel

Action of different materials on the adherence of sheet enamel. KIRST. *Glashütte*, **71**, 592–93 (1941); abstracted in *Chem. Zentr.*, **1942, I,** 402.—The experiments showed that other materials besides cobalt and nickel oxides promote the adherence of enamel to sheet iron. Some are poisonous and cannot be used. The elements whose compounds promote adherence belong mainly to groups V and VI of the periodic system. It was not possible to obtain the same action that cobalt oxide produces by the addition of one element alone, except by the use of As, but a ground enamel with good adherence to sheet iron and with the desired properties, e.g., white color, was obtained by combining several materials. The study of this Co-free ground enamel might afford a means of clarifying the mechanics and chemism of the adherence of enamel to sheet iron. M.V.C.

Boron-free sheet grounds. H. W. KLOMEN. *Emailwaren-Ind.*, **18,** 87–88 (1941); abstracted in *Chem. Zentr.*, **1942, I,** 402.—Glazes with high and low boron contents and high and low silica contents are discussed. When ZnO is used as an ingredient of the batch, there is a good fluxing action toward CaO and the expansion coefficient of the enamel is lowered considerably. M.V.C.

Defects in cast and wrought steel caused by hydrogen. CARL A. ZAPFFE. *Metal Progress*, **42** [6] 1051–56 (1942).—The role of hydrogen in causing "tears" and shatter cracks in forgings and in cast steel and in the formation of pinholes is discussed and illustrated. See "Mechanism . . . ," *Ceram. Abs.*, **22** [3] 50 (1943). B.C.R.

Effects of lithia substitution for soda in vitreous enamel. MARVIN O. LEWIS. *Jour. Amer. Ceram. Soc.*, **26** [3] 77–83 (1943).—18 references, 9 figures.

Enamel linings for chemical plant. ANON. *Chem. Age* [London], **47** [1225] 554 (1942).—Enamel-lined equipment of all types is widely used in the chemical and foodstuffs industries. It does not corrode and will not color or contaminate the product. Most of this equipment is made of low-carbon or open-hearth steel of varying thicknesses. All joints are welded inside and outside to prevent gas pockets, and the welds are ground to a smooth surface. The inner surfaces are then sandblasted to remove scale, oxide, and grease and to insure a perfectly clean surface for the enamel. The enamels withstand all ordinary rough handling and resist more physical abuse than ordinary glass. Plain, unjacketed, open mixing or storage tanks lined with enamel, ranging in capacity from 100 to 5000

gal., are used for storage and for mixing acids, organic syrups, and animal or vegetable oils. Similar vessels fitted with an agitator and jacketed for steam or oil are made up to 7000-gal. capacity. If required for cooling, brine may be circulated in the jacket, but the alternate use of steam and brine in the same jacket is undesirable and separate vessels should be used. For the storage of petroleum products, medicinal compounds, and vegetable and essential oils or for mixing liquids which do not require heat, tanks are made with capacities up to 9000 gal. For the mixing and storage of pharmaceutical and allied products, tanks are made in sizes up to 5000 gal. Where agitation or mixing is required, the propellers are enameled. It is seldom advisable to use steam for high-temperature heating because of the high pressure involved. Direct firing is also inadvisable because of carbonization at the points where heat is applied. Electricity is usually too expensive. Steam is suitable for temperatures up to 150°C., and oil heating permits temperatures up to 300°C. Oil will uniformly and rapidly transfer the heat without involving the danger of high steam pressures, and it will also permit safe construction in lighter metals. An important point in the use of enamel-lined equipment for the storage of volatile and explosive substances, e.g., dyestuffs, cellulose explosives, etc., is the provision of an electrical connection to ground. All glass-lined tanks constitute ideal electrical condensers, and if the contents are not grounded in any way and static electricity is present, a tank may become charged to a high potential, a spark may easily be formed, and, if inflammable liquids are present, a serious explosion will result. A suitable ground, however, will eliminate this trouble. A.B.S.

Enameling plant converts to war production. ARTHUR F. MACCONOCHIE. *Steel*, **111** [8] 54–55, 74–78 (Aug. 24, 1942).—The conversion of an enameling plant to war work is described. The enameling furnaces are used for annealing, stress-relieving, and spheroidizing operations. They were altered by removing the muffle, providing a car bottom, and increasing the burners from one to seven. They are well adapted to stock which does not exceed 12 ft. in length. Additional use of the plant is made in making enameled flues for defense houses, ammunition trays, ammunition boxes for merchant ships, aircraft stages, bus-bar boxes, etc. Illustrated. H.E.S.

"Fisheyes" in steel welds caused by hydrogen. CARL A. ZAPFFE. *Metal Progress*, **42** [2] 201–206 (1942).—In studying the cause of the shiny fractures of hydrogen-embrittled iron, Z. regards the shiny central blowhole as the locus to which hydrogen diffused during cooling, because a surface was immediately available for precipitation of the gas from the surrounding metal, and from which the gas later diffused when the longer gradient to the atmosphere became effective. The brilliant crystalline zone surrounding the blowhole comprises the flat crystallographic surfaces of large groups of "blocks" which have been immobilized and partly separated by the internal gas. See "Defects. . .," *Ceram. Abs.*, **20** [8] 190 (1941). B.C.R.

Fundamental study of factors influencing color of porcelain enamels. RALPH L. COOK AND ANDREW I. ANDREWS. *Jour. Amer. Ceram. Soc.*, **26** [3] 73–76 (1943).—4 references, 9 figures.

Fundamentals of core making and the selection of proper core-baking equipment: I–III. F. H. FABER. *Ind. Heating*, **9** [10] 1381–84 (1942); **10** [1] 84, 86, 89–90; [2] 242–50, 254 (1943).—The methods of manufacturing perfect cores for metal casting with faster baking cycles and added foundry savings are discussed exhaustively. Sand should be selected to suit the particular core and the particular pouring temperature of the metal to be cast on the following basis: condition and nature of sand, grain size, contour, fusibility, permeability, and collapsibility. Proper binders improve core-room efficiency. Core oils are preferable to any other kind of core and mold binder for most uses and especially for highly intricate cores. About 90% of all core binders in production consist of oil, the remaining 10% being cereal, pitch, etc. The less oil used in a core, the better will be the results in the core oven and the casting room. When too much cereal binder is used, however, it will pick up moisture from the air and create excessive gases in casting. Oil and sand ratios should be predetermined for various jobs. Baking should be done in three steps: (1) preheating to approximately 212°F., (2) evaporation of core moisture, and (3) oxidation of core oils. Several types of modern core-baking and mold-drying ovens and equipment are described. A modern trend is to combine several functions in one oven, and a combination oven for baking cores, stress-relieving gray-iron castings, annealing nonferrous metals and alloys, etc., is described. The temperature ranges required for the different purposes are obtained through a dual burner system. One burner system maintains the steady heat for core baking and mold drying, and the second burner system gives a constant even temperature at any heat up to 1200°F. M.HA.

Gas opacification in boron-free enamels. LUDWIG STUCKERT. *Emailwaren-Ind.*, **18**, 80–87, 89–91 (1941); abstracted in *Chem. Zentr.*, **1942, I,** 402.—The opacity and luster of a series of boron-free wet enamels opacified with Kantabur were measured and compared with those of enamels opacified with solids, SnO_2 in some cases. Two coats of the boron-free gas-opacified enamel yielded in all cases a white content of at least 80% compared with the other enamels, which is quite sufficient for technical purposes. The luster, which is the first property to be affected because of the special composition of boron-free frits, is also high in these enamels. If the luster is several units below that of enamels containing SnO_2, it considerably surpasses in most cases the average limit reached by enamels containing boron and is sufficient for technical purposes, having values above 90%. The technical properties of the enamels, such as fusibility, coating power of the slip, annealing temperature, impact strength, and transverse strength, correspond to those of ordinary white boric acid enamels. These enamels are equal to boron-free white enamels opacified with solids in regard to opacity, luster, stability to firing, hardness, and elasticity. Gas-opacified enamels follow the sequence colored enamel–white enamel in regard to increasing sensitivity to thermal shock. The reason for the lower heat stability of white enamels in general is that they are usually used in thicker coats than colored enamels, especially the darker shades. Gas-opacified enamels are superior in chemical resistance to the other enamels tested; they surpass brown enamel in stability to acetic acid. The workability and firing properties of smelted powder enamel do not differ from those of powder enamels containing solid opacifiers. The opacity attained is exceptionally high and equals that obtained with solid opacifiers. The luster of gas-opacified powder enamels is also as high as that of powder enamels opacified with solids. M.V.C.

Heat-treating temperature control for salt baths. ANON. *Machinery* [N. Y.], **49** [3] 256 (1942).—The equipment consists of a pyrometer, timer, ammeter, and signal light mounted on a panel board; this apparatus may find usefulness in enamel plant metal-cleaning departments. R.H.B.

Manufacture of steel sheets for vitreous enamel. J. S. WALTON. Swansea Technical College presidential address, Nov., 1938; abstracted in *Enamelling Abs.*, **1** [2] 10 (1939); see *Ceram. Abs.*, **18** [7] 174 (1939). F.J.H.

Modern metal cleaning. ANON. *Mech. World & Eng. Record*, **106** [Aug. 4] 99–102; [Aug. 11] 126–27 (1939); abstracted in *Enamelling Abs.*, **1** [2] 10 (1939).—The requirements of a successful commercial degreasing plant are summarized, and the equipment and materials used in solvent degreasing are described. A detailed account of the operation of a typical plant is included. F.J.H.

Porcelain enamel for airplane exhaust systems. ANON. *Better Enameling*, **13** [12] 4–6 (1942).—Airplane exhaust systems hitherto made of stainless steel can now be made of a less critical steel and coated with porcelain enamel as has previously been done satisfactorily in the higher priced automobiles. Firing of the enamel coating also serves to stress-relieve the welded joints. B.C.R.

Relation of ground coat mill formula to sagging of cover enamels. A. M. LANGBEIN. *Ceram. Forum*, **6** [7–9] 5; [10] 5 (1940).—The defect of sagging, caused by the use of continuous furnaces, was overcome by a change in set of the ground coat. The improvement was believed to be due to the decrease in set and consequent water content at the dip tank, indicating that, despite the benefits derived from raw-material additions, control of consistency or set and water content of ground-coat enamels is of vital importance in securing a ground coat that will be resistant to sag, fish scale, and copperheads. Control of the amount of solids remaining on the ware before it is fired is the important factor. H.E.S.

Soft ground coats. J. E. ROSENBERG. *Ceram. Forum*, **7** [7–9] 4 (1941).—The need for a lowering of enamel firing temperatures to save fuel, time, and production costs is pointed out. As the ground coat is the foundation on which the enamel structure is built, R. recommends that changes be made in a conservative way only. Experience with a three-way blended ground coat in which one of the members is hard and the others are soft is given. This type of ground coat makes it possible for the enameler to feel his way with various blends and to suit the enamel to his needs. H.E.S.

PATENTS

Rust-proofing of ferrous surfaces prior to painting or enameling. S. T. ROBERTS AND F. TAYLOR. Brit. 526,815, Oct. 9, 1940 (March 14, 1939); *Enamelling Abs.*, **1** [7] 53 (1941).—A phosphate solution containing zinc and manganese (or cadmium) together with cobalt and/or nickel is used. F.J.H.

Vitreous enamel coated steel article manufacture. H. R. BELDING AND J. A. ECKEL. Can. 410,576, Feb. 9, 1943 (Jan. 2, 1942). G.M.H.

White vitreous enamelware. C. J. KINZIE AND C. H. COMMONS, JR. (Titanium Alloy Mfg. Co.). Can. 410,578, Feb. 9, 1943 (Jan. 13, 1942; April 2, 1942). G.M.H.

Zirconium oxide opacifier and method of making. C. J. KINZIE (Titanium Alloy Mfg. Co.). U. S. 2,310,242, Feb. 9, 1943 (Nov. 1, 1938).—A substantially white opacifier composition comprising crystalline zirconia intimately associated with a minor quantity of gelatinous zirconium hydrate.

Glass

Application of electricity to the annealing of glass bottles and containers. E. S. MORRIS. *Jour. Inst. Elec. Engrs.* [London], **89** (II) [10] 355–68 (1942).—The annealing of industrial glass articles is briefly outlined. The temperature of various types of machine-made glass hollow ware when leaving the machine and during cooling in air was measured by the method of mixtures. The former temperatures ranged from 669° to 795°C. The producer-gas-fired lehr is described and compared with a fully insulated electrically heated lehr. Mainly owing to the absence of insulation, the producer-gas-fired or oil-fired lehr cost 120s per day (250 gal. of oil fuel) to anneal 35 tons of glass, whereas the electric lehr cost 21s per day. The electric lehr is described in detail. Novel features include removable slag-wool insulation held in trays at the feed end and circulation of air of adjustable temperature through the rapid-cooling section. A heat balance is calculated in two cases. Two further applications of electricity are described: (1) the reheating of blown glass tumblers prior to fire-polishing of the edges and subsequent annealing and (2) the controlled reheating of milk bottles during the enameling of advertising matter thereon. L.R.B.

Binoculars see action. J. F. BRANDT. *Bausch & Lomb Mag.*, **18** [4] 4 (1943).—B. gives a general account of the use of binoculars in wartime activities. R.H.B.

British optical-glass industry. ANON. *Times* [London], July 16, 1942; abstracted in *Chem. Trade Jour.*, **110** [2874] 628 (1942).—The high-grade glass sand discovered on the banks of Loch Aline in Argyllshire just before the outbreak of the present war has proved, after purification, to be superior to any previously known. Another deposit has been discovered in Ireland. L.R.B.

Canadian development of glass fibers. R. RICHARDSON. *Jour. Can. Ceram. Soc.*, **11**, 32–35 (1942).—R. traces the development of fiber glass and outlines the method of manufacture. Present equipment permits the drawing of fibers 0.0003 in. in diameter with a tensile strength of 400,000 lb. per. sq. in. Most furnaces feed 200 orifices, and the 200 filaments are gathered into one. Thread is used for electrical insulation, chemical filters, and other technical applications. At present almost 100% goes into direct war products. G.A.K.

Coke-oven heating. G. E. FOXWELL. *Coke & Smokeless-Fuel Age*, **4** [41] 200–203 (1942).—It is calculated that heat transfer in the coke oven from the flue gases to the charge falls off considerably as soon as carbonization proceeds beyond 1-in. thickness. The radiation transfer from low-grade gases, such as producer and blast-furnace gas which burn with nonluminous flames, is considered. The convective heat transfer is that appropriate to turbulent flow, the rate of flow being estimated numerically. An analogy is drawn between the heating of a coke oven and that of a glass furnace and is developed along the lines laid down by E. J. Gooding and M. W. Thring ("Flow . . .," *Ceram. Abs.*, **21** [6] 129 (1942)). L.R.B.

Conversion of glass furnaces from oil to gas and from gas to oil. GERALD FITZ GERALD. *Bull. Amer. Ceram. Soc.*, **22** [3] 65 (1943).

Corning Multiform insulators. ANON. *Bull. Amer. Ceram. Soc.*, **22** [4] 123–24 (1943).

Depreciation and maintenance of glass furnaces and melting tanks: V. S. HOWARD WITHEY. *Glass*, **19** [10] 264–66 (1942).—Practical methods of computation and accounting are given. **VI.** *Ibid.*, [11] 295–96.—To insure available capital for equipment after the war, manufacturers should establish suitable sinking funds now rather than depending upon drawing from current income. **VII.** *Ibid.*, [12] 318, 321.—Several advantages may be derived from a revaluation of furnace equipment by an independent appraiser, such as for credit extension, insurance claims, assessments, etc. The recording of purchases and cash transactions is discussed. **VIII.** *Ibid.*, **20** [1] 12–13 (1943).—Allowable deductions in computing income taxes (British) are discussed. For Parts **I–IV** see *Ceram. Abs.*, **22** [3] 51 (1943). B.C.R.

Faster and better (optical glass). ELMER WAY. *Bausch & Lomb Mag.*, **18** [4] 8 (1943).—The production of optical glass during this war is being accelerated by modern methods of pot making. Refractory pots that hold 500 to 2000 lb. of melt are now being made by a special casting process. The pot body, which consists of high-grade kaolin, ball clay, and grog, is the result of extensive research on the part of the Bureau of Standards, the U. S. Geological Survey, and the Bausch & Lomb Optical Co. Specific details of the casting process are given, and the basic steps of pot manufacture are explained and illustrated. R.H.B.

Fiberglas: some properties and new applications. F. V. TOOLEY. *Bull. Amer. Ceram. Soc.*, **22** [3] 60–64 (1943).—3 references, 6 photographs.

Glass currents in continuous tank furnaces. Y. P. VARSHNEY. *Trans. Indian Ceram. Soc.*, **1** [2] 60–66 (1942).—The origin of thermal currents in glass tank furnaces is discussed and reviewed. Methods used for studying and gaining information concerning the subject are taken up. Attention is given to the effects of glass currents on (*a*) melting time and efficiency, (*b*) the life of tank blocks, (*c*) the presence of stones and cords, and (*d*) homogeneity. Modern trends in tank-furnace design for the elimination of the deleterious influences of thermal glass currents are discussed. P.S.D.

Glass patents and the war. S. T. MODELEY. *Glass*, **19** [12] 322–23 (1942).—Glass patents issued annually

for the period 1910–1941 are tabulated and graphed. Provisions of the 1942 Patent and Design Act are discussed. B.C.R.

Glass for precision gauges. J. A. STONE. *Amer. Machinist*, **87** [3] 75–79 (1943).—The Frankford Arsenal uses glass extensively in the form of plug, ring, snap, profile, and position gauges and flush pin gauges. The advantages are as follows: (1) Glass gauges provide visibility in inspection. (2) They are not subject to corrosion. (3) The greasing and degreasing required with steel gauges are eliminated as glass does not rust. (4) As thermal conductivity is lower than in steel, body heat is very slowly transmitted and does not affect gauging dimensions. Scratches and slight chipping on glass neither burr glass gauges nor change their gauging functions. Siezing or galling-on glass is much less than on steel, and the sense of feel is more pronounced with a glass than with a steel gauge. The abrasion-resisting qualities of glass are better than those of steel for gauging applications. When a steel gauge is dropped it may spring or deform, and its gauging functions are impaired; a glass gauge, however, either breaks or remains dimensionally unchanged. Furthermore, the use of glass teaches inspectors to handle gauges carefully. When grinding glass, S. recommends soft vitrified silicon carbide wheels 2 x $^1/_2$ to 14 x $1^1/_2$ in. in size with Nos. 60, 80, 100, and 150 grit size, preferably at a surface speed of 350 to 2400 ft. per min., a depth of cut of 0.003 to 0.005 in., a work speed of 400 ft. per min. (1-ft. diameter) and 90 ft. per min. ($^1/_4$-in. diameter) at the surface, and a soluble oil. The speed should be adjusted to each wheel so that no firing or sparking occurs, as they may cause cracks in the glass. Rouge is excellent for lapping or polishing to close dimensions. Glass gauges can be strengthened by thermal tempering, which also improves flexural strength and impact resistance. Their properties are as follows: thermal conductivity, 0.333 to 0.700 B.t.u./1 ft./1 hr./1 ft. thick/1°F. (26 for steel); linear expansion coefficient, 0.0000018/°F. for borosilicate glass to 0.0000050 for plate and crown glass (0.0000060 for steel); hardness or abrasion resistance, 6 to 7 (quartz 7, diamond 10); weight, 160 lb./cu. ft. (485 for steel); modulus of elasticity, 10,000,000 lb./sq. in. (30,000,000 for steel). Numerous gauges are described. M.HA.

Glass wicks supply food to fungi during tests. ANON. *Science News Letter*, **43** [8] 121 (1943).—Fiberglas wicks were used to convey measured quantities of dissolved accessory food substances in experiments made to combat a cloth-eating fungus that attacks canvas used in army tents. G.A.K.

Mata Hari with a glass eye. DERRYFIELD N. SMITH. *Bausch & Lomb Mag.*, **18** [4] 14–15 (1943).—Bausch & Lomb aerial lenses are helping aviators on war fronts. They are made to a high degree of perfection, so that pictures with exceptional detail can now be obtained from high altitudes. These photographs are used for studying enemy activities and troop concentrations, map making, directing bombing operations, reconnaissance, and numerous other purposes. R.H.B.

Minifying lens for aphakia. IRVING B. LUECK. *Bausch & Lomb Mag.*, **18** [4] 6 (1943).—Unilateral aphakia resulting from the removal of traumatic or contusion cataract presents a complex refraction problem. The Bausch & Lomb minifying lens is designed specifically for use with unilateral aphakics with good vision in both eyes; it is a reversed Galilean telescope consisting of a high minus objective and a strong convex eye lens fitted into a funnel-shaped plastic mount. The large objective lens is precision finished at the factory, and the small eye lens is semifinished to permit incorporation by the optician of the *Rx* power required in any instance. A part of the average aphakic *Rx* lens power is included in the eye lens when semifinished (about +6.00 diopters) to facilitate handling of the remaining surface job by the *Rx* shop doing the finishing and assembly. Light-ray diagrams of eye-lens relationships are described. R.H.B.

Portman optical comparator. ANON. *Machinery* [N. Y.], **49** [2] 204 (1942).—The comparator is furnished with lens-unit magnifications ranging from 10 to 100. The outline of small machine parts may be viewed on the 20-in. screen area. R.H.B.

Precision lenses. ANON. *Science News Letter*, **42** [26] 411 (1942).—The production of precision lenses for gun sights, binoculars, and other military instruments has been speeded by a diamond-impregnated grinding machine which automatically grinds curves or planes on glass. One to fifty lenses, depending on the size, can be made in a single operation. G.A.K.

Savoy glasshouses and the invention of flint glass. E. WYNDHAM HULME. *Glass*, **19** [10] 257–58, 269 (1942).—Historical. B.C.R.

Sealed glass bushings. W. W. GRIGORIEFF AND C. M. LAMPMAN, JR. *Jour. Amer. Ceram. Soc.*, **26** [3] 83–87 (1943).—5 references, 7 figures.

Solving wartime problems in Eire. R. M. FOX. *Chem. Age* [London], **48** [1229] 93–96 (1943).—The cessation of imports has resulted in the use of local materials, e.g., Muckish sand for glass, ocher from Avoca, barytes from Benbulben, and clays from Kilkenny, Tipperary, and Cork. The first commercial zinc oxide plant in Eire has been erected to make use of zinc waste formerly exported. A new factory for making electric bulbs uses Muckish sand and Kilkenny dolomite. Many nonceramic materials are also mentioned. A.B.S.

Use of silica sand in the glass industry in Missouri. H. L. SHEAKLEY AND D. J. COOLIDGE. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1538; *Mining Tech.*, **6** [6] 6 pp. (1942).—St. Peter's sandstone of Ordovician age is used in the Pittsburgh Plate Glass Co. factory at Crystal City, Mo. The deposit is about 65 ft. thick. Its composition is Fe_2O_3 0.024% and SiO_2 99.6%; a screen analysis shows it to be mostly between the 28- and 100-mesh sieves. A room-and-pillar method is used in mining, and only the middle 30 ft. are taken out. It is loaded by a $1^1/_4$-yd. shovel into 400-cu. ft. railroad cars with a grizzly on top. At the mill the sand is screened and then crushed in closed circuit with another screen with 0.049-in. openings; it then goes to the factory, where it is dried. A batch mixture is made up and put into the melting tank at certain intervals. The melting tank has Corhart electrocast blocks in contact with the molten glass and silica brick above. Sand used for grinding the glass is sized properly in a series of metal cones. W.D.F.

White-colored or opal glass. BRUNO SCHWEIG. *Glass*, **19** [12] 315–17 (1942); **20** [1] 5–8 (1943).—Batch compositions for alabaster, white enamel, calcium phosphate, and spar and cryolite glasses are given. In calcium phosphate glasses a furnace temperature of 1150° to 1200°C. should be used, as lower temperatures may result in roughness of the glass surface due to the formation of large lumps of phosphate glass on cooling. The substitution of soda for potash has not proved satisfactory. Although the role of aluminum in fluoride batches has not been determined definitely, its presence is considered essential. Kreidl and Weyl ("Opal. . .," *Ceram. Abs.*, **20** [4] 90 (1941)) proposed a theory involving the formation of an aluminum fluoride complex which prevents any substantial loss of fluorine. After melting, sodium, calcium, or other alkaline-earth fluorides are formed at lower temperatures. Numerous batch compositions for the production of opal glasses are presented. The use of this type of glass has increased greatly because of the diversified uses to which it may be applied. The use of gas bubbles for producing turbidity is discussed briefly. See *ibid.*, **22** [3] 51 (1943). B.C.R.

PATENTS

Apparatus for the manufacture of sheet glass. J. H. LEWIS (Blue Ridge Glass Corp.). U. S. 2,312,564, March 2, 1943 (Sept. 28, 1937).

Apparatus and method of producing mineral wool. C. D. RICHARDSON AND D. W. BURNETT (National Gypsum Co.). U. S. 2,311,870, Feb. 23, 1943 (Aug. 11, 1939).

Apparatus for producing one-piece multifocal lens blanks. F. E. DUCKWALL (Continental Optical Co., Inc.). U. S. 2,312,529, March 2, 1943 (May 17, 1940; April 15, 1941).

Bottle-testing apparatus. A. S. JACKSON AND C. A. HEYNE (Owens-Illinois Glass Co.). U. S. 2,314,310, March 16, 1943 (Aug. 16, 1940).

Burner means, especially for glassmaking furnaces or tanks. VERGIL MULHOLLAND (Hartford-Empire Co.). U. S. 2,310,704, Feb. 9, 1943 (Dec. 16, 1939; May 2, 1940).

Cellular slab. P. E. KNUDSEN (Pittsburgh Plate Glass Co.). U. S. 2,310,442, Feb. 9, 1943 (March 24, 1939).

Composite building unit. E. H. HAUX (Pittsburgh Plate Glass Co.). U. S. 2,310,432, Feb. 9, 1943 (Oct. 7, 1938).—A process of forming from crushed vitreous material a bloated cellular body having a moderately expanded relatively dense facing layer and a highly expanded backing layer of low density.

Continuous polished glass strip producing apparatus. F. B. WALDRON, L. H. DAVIES, AND J. H. GRIFFIN (Pilkington Bros., Ltd.). Can. 410,652, Feb. 16, 1943 (Sept. 11, 1940). G.M.H.

Cooling glass ribbon in Fourcault machines. RAGNAR TANBERG (vested in the Alien Property Custodian). U. S. 2,313,495, March 9, 1943 (July 19, 1939).

Electric furnace for melting glass. E. V. BOREL (Soc. Anon. des Manufactures des Glaces & Produits Chimiques de St.-Gobain, Chauny & Cirey). U. S. 2,313,217, March 9, 1943 (Aug. 10, 1937; May 22, 1940).

Feeding granular batch, particularly glassmaking batch. A. H. STEVENS (Pittsburgh Plate Glass Co.). Brit. 551,050, Feb. 17, 1943 (Aug. 6, 1941).

Feeding molten glass in plural charges. W. T. HONISS (Hartford-Empire Co.). U. S. 2,310,290, Feb. 9, 1943 (Aug. 9, 1940).

Fiber or filament of glass. ARMAND LAMESCH (vested in the Alien Property Custodian). U. S. 2,313,296, March 9, 1943 (Sept. 23, 1937).

Fibrous glass product manufacture. GAMES SLAYTER (Fiberglas Canada, Ltd.). Can. 410,232, Jan. 26, 1943 (July 29, 1940; in U. S. July 28, 1939). G.M.H.

Forming fluorescent screens. J. T. ANDERSON (General Electric Co.). U. S. 2,312,229, Feb. 23, 1943 (Nov. 27, 1940).

Glass article. H. S. WILLSON (Corning Glass Works). U. S. 2,314,804, March 23, 1943 (Dec. 7, 1938).—A glass article composed throughout of a borosilicate glass containing a substantial amount of an oxide of an easily reducible metal selected from the group consisting of lead and copper, selected portions of the surface layer of the glass having a different color than the interior portion of the glass, the selected portions being formed from the same glassforming constituents as the interior portion but having a substantial amount of the metal oxide reduced to the metallic state.

Glass article molding apparatus. H. K. RICHARDSON, A. H. LAIDIG, AND F. A. NEWCOMBE (Canadian Westinghouse Co., Ltd.). Can. 409,930, Jan. 12, 1943 (March 21, 1939). G.M.H.

Glassblowing machine. J. P. BENOIT (Owens-Illinois Glass Co.). U. S. 2,314,303, March 16, 1943 (Dec. 12, 1940).

Glass composition. R. H. DALTON (Corning Glass Works). Can. 410,376, Feb. 2, 1943 (April 1, 1940; in U. S. April 22, 1939). R. A. SCHOENLAUB (Fiberglas Canada, Ltd.). Can. 409,959, Jan. 12, 1943 (Dec. 30, 1938; in U. S. Dec. 30, 1937). G.M.H.

Glass-cutting apparatus. J. L. DRAKE (Libbey-Owens-Ford Glass Co.). U. S. 2,314,327, March 23, 1943 (April 7, 1941).

Glass distilling head. E. F. KELM (Corning Glass Works). Can. 409,943, Jan. 12, 1943 (Jan. 3, 1940; in U. S. Jan. 3, 1939). G.M.H.

Glass drill. S. K. KOTOWSKI (Libbey-Owens-Ford Glass Co.). U. S. 2,312,176, Feb. 23, 1943 (Jan. 29, 1941).

Glass enamels. RAY ANDREWS AND R. J. KING (B. F. Drakenfeld & Co., Inc.). U. S. 2,312,788, March 2, 1943 (Dec. 9, 1938).—A homogeneous enamel flux for glass melting around 1100°F. having higher resistance to acids, alkalis, and sulfides, analytically containing substantial percentages of lead oxide, silica, and boric acid, and also containing sodium oxide about 4, lithium oxide about $1^1/_2$, titanium oxide about 3, and zirconium oxide about 6%.

Glass-gathering apparatus. J. H. WILLIAMS. Brit. 550,855, Feb. 10, 1943 (July 25, 1941).

Glassmaking furnace or tank. VERGIL MULHOLLAND (Hartford-Empire Co.). U. S. 2,310,454, Feb. 9, 1943 (Dec. 16, 1939).

Glass-manufacturing apparatus. E. V. BOREL (Soc. Anon. des Manufactures des Glaces & Produits Chimiques de St.-Gobain, Chauny & Cirey). Can. 409,711, Dec. 29, 1942 (March 23, 1939). G.M.H.

Glassmelting furnaces. UNITED GLASS BOTTLE MANUFACTURERS, LTD., AND W. A. MOORSHEAD. Brit. 550,164, Jan. 6, 1943 (Nov. 26, 1941).

Glass-to-metal seal. STANTON UMBREIT (Radio Corp. of America). Can. 410,001, Jan. 12, 1943 (Nov. 3, 1938). G.M.H.

Glass-molding machine. C. B. SMITH AND J. R. JOHNSON (Owens-Illinois Glass Co.). U. S. 2,314,290, March 16, 1943 (Sept. 18, 1941).

Glass and process of making. H. A. TRUBY (Pittsburgh Plate Glass Co.). U. S. 2,313,685, March 9, 1943 (Jan. 31, 1941).—A process of obtaining substantially colorless high barium crown glasses which comprises adding 0.5 to 1.5% by weight of a phosphate to the batch from which the glass is prepared to eliminate the color normally resulting when the batch is melted.

Glass wall and block. T. W. ROLPH (Holophane Co.). Can. 409,976, Jan. 12, 1943 (Oct. 12, 1939). G.M.H.

Glassware-forming machine. J. W. WATT (Owens-Illinois Pacific Coast Co.). U. S. 2,310,721, Feb. 9, 1943 (Oct. 31, 1940).

Glassware-selecting method. P. L. ORR AND W. W. SHAVER (Corning Glass Works). Can. 410,377, Feb. 2, 1943 (Jan. 24, 1941; in U. S. Feb. 28, 1940). G.M.H.

Glassworking apparatus. D. E. GRAY, L. N. POND, AND W. C. WEBER (Corning Glass Works). Can. 410,378, Feb. 2, 1943 (July 15, 1939; June 30, 1941). G.M.H.

Heating oven, particularly for hardening glass plates. FELIX VRANKEN (vested in the Alien Property Custodian). U. S. 2,311,908, Feb. 23, 1943 (April 17, 1939).

Laminated glass. L. W. BENOIT (American Chain & Cable Co.). Can. 410,346, Feb. 2, 1943 (March 5, 1941; in U. S. Dec. 30, 1940). G.M.H.

Machine and method for forming and welding hollow glass blocks. W. S. MAYERS. U. S. 2,313,160, March 9, 1943 (Sept. 3, 1937).

Making glass articles. H. H. BLAU AND R. W. KELL (Corning Glass Works). U. S. 2,314,812, March 23, 1943 (March 7, 1940).

Making glass articles. C. H. GREENE (Corning Glass Works). U. S. 2,314,824, March 23, 1943 (March 1, 1940).—A method of making glass articles which includes finely pulverizing glass, molding the pulverized glass to shape, and sintering the shaped mass to a transparent article in an atmosphere of steam at atmospheric pressure.

Making lenses. R. F. BARDWELL AND J. H. SMITH (American Optical Co.). U. S. 2,310,925, Feb. 16, 1943 (Oct. 11, 1939).

Manufacture of cellular bodies. WILLIAM OWEN (Pittsburgh Plate Glass Co.). U. S. 2,310,457, Feb. 9, 1943 (Feb. 8, 1938).

Manufacture of glass plates. R. R. MCGREGOR (N. S. Garbisch). U. S. 2,313,566, March 9, 1943 (Nov. 29, 1939).

Manufacture of glass tubing. H. F. TEICHMANN (Forter-Teichmann Co.). U. S. 2,310,474, Feb. 9, 1943 (Aug. 10, 1940).

Method and apparatus for drawing sheet glass. A. H. STEVENS (Pittsburgh Plate Glass Co.). Brit. 550,264, Jan. 13, 1943 (Aug. 6, 1941).

Method and apparatus for feeding glass. L. D. SOUBIER (Owens-Illinois Glass Co.). U. S. 2,310,715, Feb. 9, 1943 (May 4, 1940).

Method and apparatus for perforating glass articles. R. A. HINKLEY (Corning Glass Works). U. S. 2,314,826, March 23, 1943 (May 14, 1940).

Method and apparatus for producing glass fibers. S. M. DOCKERTY (Owens-Corning Fiberglas Corp.). U. S. 2,313,630, March 9, 1943 (Sept. 12, 1939).

Mineral-wool furnace. W. R. SEIGLE, H. J. O'BRIEN, AND G. S. SMITH (Johns-Manville Corp.). Can. 410,102, Jan. 19, 1943 (July 19, 1938). G.M.H.

Ophthalmic lens. L. G. GAGNON AND H. R. MOULTON (American Optical Co.). Can. 410,204, Jan. 26, 1943 (April 28, 1941). G.M.H.

Optical objective. ARTHUR WARMISHAM (Taylor, Taylor & Hobson, Ltd.). Can. 409,849, Jan. 5, 1943 (Feb. 10, 1942). G.M.H.

Optical system. ARTHUR WARMISHAM (Taylor, Taylor & Hobson, Ltd.). Can. 409,847, Jan. 5, 1943 (May 8, 1941). Can. 409,848, Jan. 5, 1943 (May 14, 1941). G.M.H.

Optical testing and measuring apparatus. HANS HAUSER (A.-G. für Optisch-Mechanische Erfindungen). U. S. 2,313,639, March 9, 1943 (Feb. 12. 1941).

Process and means for grinding glass plates. P. E. M. J. MOLS (vested in the Alien Property Custodian). U. S. 2,313,493, March 9, 1943 (Feb. 12, 1940).

Producing bent laminated safety glass. C. F. BINKERT (Libbey-Owens-Ford Glass Co.). U. S. 2,314,325, March 23, 1943 (Jan. 24, 1942).

Production of electrically conductive glass fibers and applications thereof. A. E. EDWARDS (Owens-Corning Fiberglas Corp.). Brit. 551,166, Feb. 24, 1943 (Aug. 8, 1941).

Reheating furnace. H. R. SCHUTZ (Libbey Glass Co.). U. S. 2,313,698, March 9, 1943 (March 30, 1940).

Severing lengths of glassware. H. H. SNYDER (Forter-Teichmann Co.). U. S. 2,310,469, Feb. 9, 1943 (June 9, 1942).

Sheet glass drawing apparatus. H. L. HALBACH, W. G. KOUPAL, AND G. D. CAMPBELL (Pittsburgh Plate Glass Co.). Can. 409,832, Jan. 5, 1943 (July 25, 1941). G.M.H.

Sheet glass washing apparatus. O. H. PADDOCK AND C. B. SCHAFER (Libbey-Owens-Ford Glass Co.). U. S. 2,312,186, Feb. 23, 1943 (Jan. 27, 1941).

Spectacle lens. H. D. BEACH (Rube Kap). Can. 409,868, Jan. 5, 1943 (Aug. 14, 1941). G.M.H.

Tempering glass. J. T. LITTLETON, H. R. LILLIE, AND W. W. SHAVER (Corning Glass Works). U. S. 2,311,846, Feb. 23, 1943 (Sept. 12, 1939; Sept. 5, 1940).—A tempered glass article having its external surfaces in compression and an intermediate central zone in tension, the ratio of maximum compression in the external surfaces to maximum tension in the central zone being at least 3.25 to 1.

Wall construction. P. E. KNUDSEN AND J. A. DESMONE (Pittsburgh Corning Corp.). U. S. 2,310,443, Feb. 9, 1943 (Oct. 31, 1940).

Structural Clay Products

Distinctly colored brick produced by accurate firing control. ANON. *Brick & Clay Record*, **101** [5] 30–31 (1942). B.C.R.

Draft-system improvements in building-brick plant. ANON. *Brick & Clay Record*, **101** [2] 26–27 (1942).—By the use of forced and mechanically induced draft on kilns, the firing time was reduced $1^1/_2$ days. A waste-heat drier is connected to the kilns with overhead ducts. An experimental kiln with a concave bottom corresponding in shape to the crown has been built with expectations of obtaining a shorter firing cycle and harder-fired brick from the bottom courses. B.C.R.

Drying structural clay products. H. L. LONGENECKER. *Brick & Clay Record*, **102** [2] 26–28 (1943).—The drying of structural clay products is partly dependent on the type of clay and the size of the shape, the more plastic clays being the more difficult to dry properly. Failure to relieve forming strains in the ware prior to drying may result in cracking. Proper balance of the die may correct some drier troubles. The proper operation of driers is discussed. The introduction of live steam in the bottom of the pug mill increases production, owing to a greater column speed, and, especially in cold weather, facilitates drying provided the clay is heated to 125° to 150°F. B.C.R.

Measuring shrinkage and weight loss of Kentucky shale hollow tile. ANON. *Brick & Clay Record*, **102** [2] 25 (1943).—A test made in a commercial kiln to determine the relationship between the shrinkage of tile and its loss of weight in firing established the following facts: (1) Mechanical water discharge has no effect. (2) Chemical water discharge causes expansion. (3) Oxidation shrinks the body to normal. (4) Glass formation shrinks the body below normal, normal being considered as thoroughly dry tile before firing. B.C.R.

Modern tile and field drain drying plant. ANON. *Claycraft*, **16** [3] 96 (1942).—Drying equipment, drying shed, type of kilns, and boilers at the plant of Colthurst, Symons & Co., Ltd., Bridgwater, Somerset, are described. G.A.K.

Prefabrication up to date. F. VAUX WILSON, JR. *Brick & Clay Record*, **102** [2] 30, 32, 34 (1943).—A post-war building boom is forecast in which prefabricated housing will represent 50 to 70% of the home construction, resulting in a saving of 10 to 32%, depending upon the size of the job, the prefabricating system used, and the efficiency in execution. A working capital of $24,000 per house per year is necessary for those in the prefabricating business. B.C.R.

Use of electrolytes in manufacturing heavy clay products. R. H. ANWYL. Presented at meeting of the Ceramic Society of the Southwest, Austin, October, 1942; abstracted in *Brick & Clay Record*, **101** [6] 28, 30, 32 (1942).—The results of previous investigations on the use of electrolytes in the manufacture of clay products to obtain more rapid drying and a reduction in drier cracking and in laminations are reviewed. B.C.R.

Use of soda ash for structural clayware production by Barker-Truog process. HENRY W. HARRINGTON. *Bull. Amer. Ceram. Soc.*, **22** [3] 57–60 (1943).

PATENTS

Concrete floating and brick surfacing machine. J. W. HELTZEL. U. S. 2,312,968, March 2, 1943 (March 23, 1940).

Vitrified traffic marker. D. R. SEVER AND D. J. RENKERT (Metropolitan Paving Brick Co.). U. S. 2,313,673, March 9, 1943 (July 26, 1941).

Refractories

Applications of magnesitic ramming mixtures. HARVEY N. BARRETT, JR. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining & Met. Engrs.*, **25**, 53–61 (1942).—Ramix, a cold-ramming high-magnesia refractory, may be used in rebuilding after tearing out portions of the hearth or of the banks. It is tamped in up to or just below the old level, the furnace is brought up to temperature, and the entire hearth is dressed. If a furnace is enlarged by lengthening or widening, one wall is moved back and the interval is filled in with Ramix. In a new installation, wooden forms may be used to make a terraced contour on the banks. Forms are not usually used on the ends. When installing the hearth the whole flat is rammed in first, generally in two sections, one at each end; this is continued to the center. The thickness should be at least 6 in. and may be 18 in. Ramix can be installed rapidly by ordinary labor. A bottom is considered to have three divisions: (1) sub-hearth, pan, insulation, and brick but not refractory

enough for steel melting; (2) permanent hearth, a monolithic rammed high-magnesia hearth; and (3) replenishable hearth, a burned-in hearth of granular refractory on the working hearth. See "Modern. . .," *Ceram. Abs.*, **21** [9] 191 (1942). W.D.F.

Bottoms for the basic open hearth. I. A. NICHOLAS. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining & Met. Engrs.*, **25**, 63–67 (1942).—A new bottom carries 70% MgO, while an old bottom has only 20%; other changes are an increase of iron oxide to 50%, a drop in silica to one-half, and a doubling of CaO. Old bottoms carry as much iron as does the ore and may react to form iron, causing a bottom boil. It would seem economical to resurface an old bottom regularly to enrich the MgO content. StaSet, an artificial magnesite, is made from dolomite. StaSet Special C is made by adding chrome ore to StaSet; with this a deep bottom or bank hole can be patched in one operation. The material can also be used in repairing bottoms and banks and in rebuilding. W.D.F.

Clay sleeve made by new methods. ANON. *Clay Prod. News*, **16** [1] 4 (1943).—The National Fireproofing Corp.'s improved process for the manufacture of sleeves and nozzles for hot-metal ladles permits the forming of sleeves in lengths as long as practicable for handling in the making up of stopper-rod assemblies in the steel mill or foundry. G.A.K.

Coke ovens and wartime conditions. R. J. BARRITT AND C. H. NEWBY. *Gas World* [*Coking Section*], **29** [352] 6–10 (1942).—Wartime conditions have necessitated the interruption of coke charging and discharging during alert periods and the provision of a shed over the coke side. This has resulted in (*a*) damage to oven soles due to fusion, spalling, or excessive wear and spalling of oven walls, particularly those adjacent to the soles, and (*b*) breakage of door frames and damage to self-sealing doors, particularly on the coke side. Methods used to replace eroded sole blocks are described. Sometimes cement can be used to bring the level up to normal. The rebuilding of the two outer flues of a silica wall while gas is on in adjacent flues is made possible by building temporary insulating brick walls against adjacent flues, by stoppings on either side of the damaged silica wall, and by the use of fireproof clothing. A jack is used to retain the roof in position during these repairs. L.R.B.

Examination of refractory materials. P. F. F. CLEPHANE. *Gas World*, **117** [3035] 397–98 (1942).—C. replies to comments on his method for the determination of the degree of inversion of quartz in silica brick (see "Microscopic. . ." and "Refractory. . .," this issue). From July, 1940, to May, 1942, 1194 silica brick specimens from three makers were examined by the Gas, Light and Coke Co. The average equivalent quartz content was slightly under 2.5%, and the average quartz of the worst delivery was under 8%, the bulk of the brick being cristobalite. C. emphasizes the fact that quartz, when heated in the stability range of tridymite, passes first to the metastable cristobalite. After 2000 to 3000 working hours in retort-house brickwork, there is no great change in composition, but some increase in tridymite is noticeable, especially at hot spots and in areas affected by slag attack. L.R.B.

High-temperature heat insulation. G. W. PATERSON. *Jour. Can. Ceram. Soc.*, **11**, 13–32 (1942).—P. discusses high-temperature heat insulation under the following subjects: (1) Heat conductivity. The *K* values for several insulating materials are listed. (2) Types of lightweight insulation: (*a*) vermiculite, (*b*) diatomite, (*c*) 85% magnesia, and (*d*) mineral wool. (3) Forms in which insulation is applied: (*a*) loose fill, (*b*) plastic insulation, (*c*) insulating concrete, and (*d*) block form. (4) Manufacture of refractory insulating brick. (5) Coatings and joining cements. (6) Insulation engineering. (7) Applications: (*a*) blast furnaces, (*b*) open-hearth steel furnaces, (*c*) rolling mills, (*d*) electric steel-melting furnaces, (*e*) iron foundries, (*f*) copper and nickel smelters, (*g*) brass, light metals, and gold, (*h*) glass, ceramics, and Portland cement, (*i*) core and mold ovens, (*j*) annealing and forging, and (*k*) miscellaneous applications. Illustrated. G.A.K.

Improved dry-press practice for chrome and magnesia refractories: I–III. GILBERT E. SEIL. *Brick & Clay Record*, **101** [2] 38, 40, 42; [3] 46, 48–50; [4] 44, 46–47 (1942).—Through the use of diagrams, S. suggests three changes in the mechanism of a Boyd press for producing denser brick. To prevent segregation of particles in the brick mix, he advocates the use of a remixer placed as closely as possible to the mold box, replacing the normal brick hopper. The action of the blades in the remixer is described and illustrated. B.C.R.

Improving the plasticity of chrome ores. F. L. TOY. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining & Met. Engrs.*, **25**, 69–70 (1942).—Finer grinding will help plasticity, but it may also be necessary to use a plasticizer, such as shale. In general, the chrome ore should be fine enough to pass at least an 8-mesh sieve. Fine grinding also helps to distribute gangue material more evenly and to make possible a more thorough mixing of magnesite with it in order to form forsterite and thus prevent high shrinkage. With sufficient plasticity and with the silicates stabilized, the chrome ore may still dry and slough off from a patch, resulting in excessive waste. Binders must be used to avoid this; they may be powders, pitch, or glutens. Cuban chrome ore tends to break into separate chunks or pop on heating. Magnesite helps to reduce this tendency, and mixtures may be tested in a small furnace at 2500°F. Sometimes olivine, chrome ore, and magnesite are mixed together for use in certain parts of the furnace. W.D.F.

Inorganic constituents (of coke): their action in carbonizing practice. ANON. *Coke & Smokeless-Fuel Age*, **4** [36] 111–14 (1942).—The work of the British Refractories Research Assn. during the last decade on the subject of slag attack on refractories is summarized. A study by Rueckel on the action of ash on coke-oven walls (*Jour. Amer. Ceram. Soc.*, **21** [10] 354–60 (1938)) is considered in more detail. It is suggested that iron may be transported into the refractory walls of the coke ovens from the coal ash in the form of iron carbonyl. L.R.B.

Insulating refractory brick. ANON. *Brick & Clay Record*, **102** [2] 41–44 (1943).—The demand for lightweight insulating brick has brought many refractories and structural clay products manufacturers into the field. Methods of mixing, pressing, drying, and firing this type of brick are reviewed. In using tunnel kilns for firing, steam may be utilized for controlling temperatures, for either holding a certain temperature or reducing excessive temperature rises. Mention is made of various methods of obtaining sufficient porosity, e.g., through the use of burn-out materials and by the development of bubbles. B.C.R.

Madagascar graphite. ANON. *Chem. Age* [London], **47** [1223] 494 (1942).—Apart from Ceylon, Madagascar is the only country in which graphite is produced in sufficient quantities and obtains a sufficiently high price to warrant export on a large scale. High-grade graphite is unequaled in certain respects in the manufacture of crucibles. The deposits of crystalline graphite in Madagascar are practically inexhaustible. The raw material is of fairly high grade, averaging 10 to 12% graphitic carbon, with a particle size of between 20- and 60-mesh and an apparent density of about 0.8. Amorphous graphite is also found in Madagascar. A.B.S.

Magnesium. SAMUEL H. DOLBEAR. *Mineral Ind.*, **50**, 345–50 (1941).—A brief description and the expected tonnage are given for new processes for producing magnesite in the U. S. B.C.R.

Microscopic determination of silica refractories. P. F. F. CLEPHANE. *Gas Jour.*, **239** [4135] 282–88 (1942); *Gas World*, **117** [3022] 118–22 (1942).—The powder method for determining the refractive index of grains of silica brick for gas manufacture has been applied by A. Edwards to estimate the proportions of quartz and cristobalite in a scraping from the surface of the previously cleaned brick. Grains 0.01 mm. in diameter from 20 brick are prepared, and 200 grain lots are immersed in turn in liquids with refractive indices of 1.486, 1.493, 1.500, 1.510, and, if necessary, upward in steps of 0.010. The number of grains (allowing for their sizes) and the percentage falling between each pair of refractive index values are estimated

by the Becke method. It has been proved that silica with a refractive index midway between 1.549 (quartz) and 1.486 (cristobalite, the major constituent) has a specific gravity midway between that of quartz and of cristobalite and is still capable of half the expansion of quartz. Material with a refractive index between 1.52 and 1.55 may be sluggish quartz or glass, distinguished by examining in polarized light. Material with indices falling below 1.486 may be tridymite or siliceous glass, distinguished in the same way. This also applies to lime- or clay-bonded ganister. If quartzose is clay bonded, it remains substantially as quartz throughout the life of the setting. In such refractories, partly inverted quartz and glass must be distinguished in the refractive index range 1.55 to 1.53. It has been proved that the degree of inversion of the interior is not less than that of the surface from which the sample was taken. See "Refractory. . ." and "Examination. . .," this issue. L.R.B.

Postwar problems. F. Booley. *Gas World* [*Coking Section*], **29** [347] 2–3 (1942).—After discussing the prevention of gas leakage through coke-oven doors, B. refers to the corrosion of silica brickwork experienced in recent years, probably because of higher operating temperatures. Under certain conditions, iron oxide from the coal diffuses into the silica brickwork and forms a fayalite glass a short distance from the front face. The brickwork becomes eroded, and this is aggravated by spalling. In addition, methane-type carbon is deposited, owing to the increased iron content, generating further active centers for deposition. L.R.B.

Preliminary studies on uncalcined kyanite-clay mixtures. T. W. Talwalkar and A. K. Sinha. *Trans. Indian Ceram. Soc.*, **1** [2] 72–84 (1942).—A survey of the literature shows that reports have already been made on the volume changes and other properties of uncalcined kyanite with clays and bauxite or diaspore, etc., and some of these mixtures show little or no change from the unfired volume to the fired volume. Presumably, the expansion of kyanite and the contraction of the other materials in these mixtures have been well balanced. Further data are presented on the use of local kyanite and clays. Two different types of mixtures were developed: (*a*) mixtures in which the fired volume at a given temperature is the same as the unfired volume but in which there may be some abrupt changes of volume in the intermediate stages; and (*b*) mixtures in which there is a small amount of contraction from the unfired to the fired state but in which there is little abrupt change at any intermediate stage. The second type may be useful for brickmaking and the first type for cements and ramming mixtures. For the second type 50% or more of clays should be used, and for the first type higher amounts of kyanite are necessary. Individual study is necessary for the particular type of clay used. High-grade clays do not make so good a batch as lower grade clays. The major expansion of the kyanite in this investigation took place at or below 1300°C., which is somewhat lower than that reported by many of the previous workers. P.S.D.

Production methods of assay crucibles and smelting pots. Clement Armann. *Clay Prod. News*, **16** [1] 8 (1943).—The quality of an assay crucible depends on the quality of raw material used, composition of the batch, proportioning of grain sizes, moisture content, method of manufacture, drying, and firing. The dry-pressing process by either hand-operated or power presses is used in the plant of Armaco, Ltd., Acton, Ont. G.A.K.

Refractory materials: important factors in the efficient utilization of fuel. Anon. *Gas World*, **117** [3030] 296–98 (1942).—Points touched on are (1) the ignorance of the value of insulation which still persists, (2) the leakage of air into furnaces through cracks in the walls, (3) the determination of the mineralogical content of silica brick, especially by Clephane's method which is criticized (see "Microscopic. . ." and "Examination. . .," this issue), (4) the silica inversions, and (5) the degree of quartz inversion commonly found in silica brick. L.R.B.

Soaking-pit and reheating-furnace refractories. J. H. Chesters. *Iron Age*, **150** [3] 35–42; [4] 38–43 (1942).—Soaking pits are of four types: (1) reversing regenerative pit, in which combustion occurs in the ingot-heating chamber; (2) one-way fired recuperative pit, in which air is preheated and firing takes place in a deep chamber; waste gases are exhausted on the same side as the firing at a point near the bottom; (3) recuperative pit fired from a central point in the bottom; waste gases are exhausted through four ports in the lower part of the walls; very high preheat temperatures are obtainable; (4) tangentially fired circular pit with burners at an angle of 37.5° from the radii, fired into a bridge wall which keeps the flame from direct impingement on the ingots. Reheating furnaces are of numerous types requiring a wide range of refractories. Refractories suggested for three types of furnaces have been selected largely by trial and error. For both soaking pits and reheating furnaces, C. indicates specific refractories for roofs, side walls, and hearths, comments on the causes of failure, and suggests lines of improvement which are as much a matter of design as of material. E.H.McC.

Suitability of Indian fire clays for steel ladle brick. H. K. Mitra. *Trans. Indian Ceram. Soc.*, **1** [2] 51–59 (1942).—Refractory firebrick used in India for lining steel ladles, although made of high alumina content fire clay, do not give the same service as some brick made from low-grade fire clay in other countries. Service conditions prevailing in steel ladles are discussed and analyzed. M. considers that high aftercontraction of the Indian ladle brick is the cause of the inferior service given by them. Two brands of brick were specifically made with reduced aftercontraction and tried under actual operating conditions. Laboratory and service test data on the two brands and on the brand of brick ordinarily used are given. From these data it is apparent that the brick with low aftercontraction are superior to the commonly used brick. By lining ladles with these specially made brick, it was possible to take more than one and one-half times as many casts as taken by ladles with the ordinary brick lining. Other noticeable features of the specially made brick are (*a*) tightness of joints, (*b*) uniform wear of brick and absence of pronounced attack at the joints, (*c*) comparatively less damage from skulling, and (*d*) ease of removal of any skulls formed. P.S.D.

Testing of silica refractories. J. W. Stacey. *Gas Jour.*, **226**, 749–50 (1939).—The testing methods advocated in 1934 by the Institution of Gas Engineers for refractory materials are described with particular reference to silica materials. The work of the British Refractories Research Assn. is reviewed. L.R.B.

Thermal conductivity of some industrial materials. Ezer Griffiths, R. W. Powell, and M. J. Hickman. *Jour. Inst. Fuel*, **15** [83] 107–20 (1942).—Various types of apparatus devised for high-temperature thermal-conductivity determinations are described. Data are presented for refractories, insulating brick, granular and fibrous materials, mica, carbon, graphites, and metals. The packing under load of compressible materials is discussed, and experiments to determine the settlement of slag wool in a cavity wall are described. A marked change in the thermal conductivity of certain phlogopite micas on heating to about 200°C. led to an X-ray examination which confirmed the belief that the original perfect plane crystal had disintegrated into a number of tilted elements. The effect of impurities on the conductivity of iron is less at high temperatures than at normal temperatures. In addition, the values at a particular temperature lie reasonably well on a smooth curve when the thermal conductivity is plotted against the total equivalent carbon content of the added elements. The thermal conductivity of carbon is much less than that of metals, while one of the natural graphites studied has a conductivity exceeding that of copper at normal temperatures. Its conductivity, however, decreases rapidly with increase in temperature. The possibility of deriving the thermal conductivity of a metal from a knowledge of its electrical resistivity is considered. **Discussion.** Lessing et al. *Ibid.*, [84]

147–49. See "Determination. . .," *Ceram. Abs.*, **21** [1] 14 (1942). H.E.S.

Turkish chrome. ANON. *Chem. Age* [London], **48** [1229] 98 (1943).—Turkey's output of chrome ore, after falling materially in the first two years of the war, has risen again through the fuller utilization of the old mining areas in the western part of the country, which, since the middle of the last decade, have been largely superseded by the development of new mines in eastern Anatolia. Before the war, Turkey supplied over 200,000 tons of chrome ore a year (one-fifth of the world production), but in 1940 its supplies had fallen to 110,000 tons. The current rate of production appears to be near the prewar rate, although definite information is not available. Allied supplies of chrome ore from other sources are on the upgrade. Developments have been particularly active in recent months in South Africa, Southern Rhodesia, and India, as well as in the U. S. See *Ceram. Abs.*, **22** [1] 20 (1943). A.B.S.

Works problems arising from blackout conditions. G. W. J. BRADLEY. *Gas World* [*Coking Section*], **29** [350] 20 (1942).—A cause of deterioration of coke-oven sole brick (floor) is water in the coal as charged, which trickles down, bearing dissolved salts which corrode the refractory brickwork. L.R.B.

SEPARATE PUBLICATIONS

Dolomite-Base Refractories. ALVIN SCHALLIS. *U. S. Bur. Mines Information Circ.*, No. 7227, 11 pp. (Jan., 1943). Free.—The developments in the manufacture of basic refractories from dolomite are believed to foreshadow an era in which it will no longer be necessary to transport refractory magnesite over great distances, because refractories of local origin and of equal or superior quality will be available. R.A.H.

Furnace-Gas Pressure as Affecting the Life of Refractories. STUART M. PHELPS. *Amer. Refrac. Inst. Tech. Bull.*, No. 79, 8 pp. (Feb., 1943).—The importance of the effect of the pressure of combustion gases within a furnace on the life of the refractory is pointed out. In the course of development of the panel spalling test procedure, it was found advisable to learn the effect of furnace-gas pressure during the preheating period on the subsequent spalling behavior. The temperature at the junction of brick and backup insulation dropped over 1300°F. when the furnace-gas pressure was changed from plus $1^3/_4$ in. to minus $1^7/_8$ in. The same brick also showed about seven times as much spalling loss at the high furnace-gas pressure. The cause is believed to be the depth to which the heat has changed and impaired the structure of the brick; increased pressure thus deepens the layer which is sensitive to thermal shock. Volume changes which occur in the refractory with heat-treatment may also be affected by increased gas pressure. Longer service can be obtained from refractories by lowering the pressure of the furnace gases either by changes in design or by an improved method of operation. H.E.S.

Kyanite Insulating Refractories by the Dry-Press Method. J. W. WHITTEMORE AND A. W. ALLEN. *Bull. Virginia Polytech. Inst. Eng. Expt. Sta. Series*, No. 52, 40 pp. (Sept., 1942).—The mechanism of heat insulation in a porous refractory is discussed with emphasis on (*a*) mathematics of heat flow, (*b*) heat storage and flow in a porous body at high temperatures, and (*c*) effect of structure on refractory characteristics. Requirements of insulating refractories are listed. The manufacture of insulating refractories is described, and their classifications are given. The adaptation of kyanite as an insulating refractory material is discussed. The kyanite used in this investigation was from the Baker Mountain, Va., deposit. Organic combustibles used to develop cellularity in the fired products were wood flour, cork, pulverized peanut hulls, and a pulverized product of corn refining. Bond clays used were (1) Putnam kaolin, (2) Kentucky No. 5 ball clay, and (3) American Colloid Co. bentonite. Fluxes and mineralizers included (1) Virginia apatite, (2) Loomis No. 1 Tremoline Talc, (3) borax, and (4) National Aluminate Corp. (No. 441 bond) sodium aluminate. Organic binders used for the development of satisfactory dry strength of the pressed products were (1) dextrin and (2) a by-product lignin extract from the paper industry. Sodium aluminate (No. 441 bond) was also used as a binder in the experiments. From the results of numerous tests on various combinations of the above raw materials, using kyanite of various particle-size gradings and both laboratory and commercial firing conditions, the following conclusions were drawn: (1) The decrease in bulk density produced by the expansion which results from increased grain size of the kyanite content of the bodies on firing above the inversion temperature range of the kyanite is accompanied by a decided decrease in the fired strength of the product. (2) Bulk density and compressive strength depend, in addition, upon (*a*) "forming afterexpansion," a quantity which measures the characteristic resilient property of insulating bodies containing organic combustibles; (*b*) presence of fluxing or mineralizing materials in the body; (*c*) heat-treatment to which the body is subjected; and (*d*) pressure of forming of the body. (3) "Forming afterexpansion" of the pressed body depends upon (*a*) ratio of clay and nonplastic materials to the amount of combustible in the body; (*b*) grain size and physical characteristics of the combustible; and (*c*) pressure of forming. In general, an increase in the amount or grain size of the combustible increases the "forming afterexpansion." Time allowed at the end of the pressure stroke of the pressing operation seemed also to influence the "forming afterexpansion." (4) Certain materials known to increase the plasticity or dry strength of ordinary ceramic bodies have the effect of decreasing the "forming afterexpansion" when added in small amounts to these dry-press bodies, notably 3% bentonite and 1% sodium aluminate or 3% bentonite and 2% dextrin. (5) An increase in the "forming afterexpansion," in addition to affecting the unfired properties of the bodies, decreases the bulk density and the compressive strength of the fired bodies. Twenty per cent "forming afterexpansion" is not detrimental to the structure, either fired or unfired, if suitable dry bonding agents are used. Properly controlled in this manner, "forming afterexpansion" may even be desirable in reducing the bulk density of dry-pressed bodies of the type investigated. (6) One to two per cent Virginia apatite or 1% sodium aluminate tends to increase the fired strength of bodies without appreciably increasing bulk density or the tendency to warp during the firing. (7) To develop sufficient fired strength, bodies must be fired to a temperature above the inversion range of the kyanite. Careful control of the firing rate is essential, especially in that portion of the firing where the inversion of kyanite occurs. (8) A specific range of forming pressure recommended to be used exists (5000 to 7000 lb. per sq. in.) for the type of samples studied. (9) A 3:1:1 ratio of 35-mesh kyanite to clay to combustible, with proper bonding agents added and 20% water of forming, produces an insulating refractory having excellent dry properties, a bulk density of 60 lb. per ft.^{3}, 0% reheat shrinkage when held at 2650°F. for 24 hr., and a crushing strength of about 140 lb./in.^{2}. These properties are for a body fired specifically to cone 27^1 (2903°F.) in 20 hr. Brick thus produced exhibit 15% volume expansion when fired and require very little trimming to produce a piece of accurate dimensions. The fact that the brick expands rather than shrinks during firing is of decided advantage in minimizing warpage. (10) A commercially satisfactory insulating refractory may be produced, using the dry-press method of forming, where a controlled proportion of raw kyanite to combustible to bonding agents is used with correct forming pressures. These insulating refractories could be produced more economically than the present commercial product, and they have more refractory properties and less shrinkage on reheating. Such insulating refractories should assist greatly in meeting the excessive demands of the war effort. See "Development. . .," *Ceram. Abs.*, **21** [5] 103 (1942). P.S.D.

PATENTS

Aluminum extraction from bauxite. T. R. HAGLUND. Can. 409,880, Jan. 12, 1943 (Oct. 1, 1937). G.M.H.

Bauxite ceramic and method of making. J. A. HEANY (Heany Industrial Ceramic Corp.). U. S. 2,311,228, Feb.

16, 1943 (June 29, 1936).—A vitreous-like, dense, nonporous, hard, amorphous, unfused, and ignited bauxite containing a small amount of an alkali-metal compound, possessing a conchoidal fracture and a hardness of approximately 74 to 76C on the Rockwell scale hardness-testing machine, the bauxite having been dehydrated before forming and firing at a temperature substantially below 1000°C.

Ceramic from bauxite and process of making. J. A. HEANY (Heany Industrial Ceramic Corp.). U. S. 2,310,953, Feb. 16, 1943 (June 29, 1936).—A process of producing an unfused, vitriclike, dense, nonporous, amorphous, formed, and fired article of the mineral bauxite which comprises preparing an amorphous, dehydrated bauxite by dehydrating the bauxite at a temperature below 1000°C., forming a mixture of amorphous, dehydrated bauxite with a small percentage of a water-soluble magnesium compound, an alkali-metal compound, and water, wet grinding in a pebble mill, mixing or pugging the mixture, forming the mass into the form of an article desired, and firing the article to a temperature of between 1300° and 1450°C.

Ceramic insulator. L. R. SHARDLOW (Radio Corp. of America). U. S. 2,314,107, March 16, 1943 (Dec. 27, 1939).—An unvitrified ceramic body of magnesia, silica, and alumina intimately admixed and fired into a strong coherent porous mass consisting of, by weight, 75.4 to 96.5 magnesia, 2.6 to 18 silica, and 0.6 to 8.26% alumina, the magnesia comprising discrete particles bonded by glass containing the alumina and silica.

Furnace arches and walls. G. WATSON. Brit. 550,266, Jan. 13, 1943 (Aug. 15, 1941).

Furnace lining. A. B. AGNEW (Harbison-Walker Refractories Co.). Can. 409,479, Dec. 22, 1942 (March 1, 1941; in U. S. May 9, 1940). G.M.H.

Making magnesia ceramics. J. A. HEANY (Heany Industrial Ceramic Corp.). U. S. 2,313,746, March 16, 1943 (Oct. 16, 1937).

Refractory. J. C. MCMULLEN (Carborundum Co.). U. S. 2,310,591, Feb. 9, 1943 (Nov. 30, 1937).—A fused cast refractory article composed of 15 to 40 magnesia, 50 to 80 lime, and 5 to 20% iron oxide.

Refractory. G. E. SEIL (E. J. Lavino & Co.). U. S. 2,311,970, Feb. 23, 1943 (July 23, 1941).—A refractory body comprising an iron-free chromite spinel in a ground mass of magnesium orthosilicate, with magnesioferrite, periclase, and monticellite dispersed in the ground mass.

Refractory composition. M. H. BERNS (Electro Refractories & Alloys Corp.). U. S. 2,314,758, March 23, 1943 (July 10, 1940).—A refractory composition for supporting loads at high temperatures consisting of silicon carbide, mullite in sufficient quantity to encase the particles of silicon carbide with a protective coating of mullite, and approximately 10% of a vitrified clay binder.

Tin oxide refractory body manufacture. DAN. MCLACHLAN, JR. (Corning Glass Works). Can. 409,946, Jan. 12, 1943 (April 7, 1941; in U. S. May 18, 1940). G.M.H.

Terra Cotta

Ceramic grates. ANON. *Brick & Clay Record*, **101** [6] 13 (1942); *Science News Letter*, **43** [2] 24 (1943).—Several types of the new ceramic fireplace grates are described and illustrated. It is estimated that they will save 30,000 tons of cast iron. Some of the ceramic firms manufacturing this product are given. B.C.R. + G.A.K.

Fitting glazes to ceramic bodies. H. G. SCHURECHT. *Jour. Amer. Ceram. Soc.*, **26** [3] 93–98 (1943).—11 references, 10 figures.

Uses and properties of acidproof cements. JOHN H. S. BARR. *Chem. & Met. Eng.*, **49** [10] 96–99 (1942).—The use of sulfur, sodium silicate, and resin cements for laying acidproof brick is discussed. Resin cements have advantages over sodium silicate but because of their high cost are often used as a pointing material on other types of cement. B.C.R.

SEPARATE PUBLICATION

Fire-clay Bases for Use with Open Fires. War Emergency British Standard Specification No. 1074—1942. British Standards Inst., London. Price 1s.—This Specification is intended for use only with 16-in. fireplaces made of fire clay and not for combination grates or fireplaces with back boilers. The requirements are as follows: height of front $3^1/_2$ in., height of back $2^1/_2$ in., length of front 15 in., length of back $8^3/_4$ in., depth from back to front of wings 7 in., minimum radius of wings 1 in., projection beyond front of wings $3^1/_2$ in., width of flat around sides and back $1^1/_2$ in. There shall be four ribs radiating from front to back $^3/_4$ in. high and $^3/_8$ in. in radius. A.B.S.

PATENT

Ceramic heating element and gas heater embodying the same. R. A. DUDLEY (Armstrong Products Corp.). U. S. 2,310,406, Feb. 9, 1943 (July 26, 1939).

Whiteware

Characteristics and performance in service of high-voltage porcelain insulators: I, Testing equipment and methods as used by the Central Electricity Board. J. S. FORREST. *Jour. Inst. Elec. Engrs.* [London], **89** (II) [7] 60–92 (1942).—The electrical characteristics and performance in service of porcelain insulators for outdoor high-voltage apparatus are dealt with. Field tests are made with a new instrument which detects faulty units by the abnormally low potential drop across them. **II, Results of tests, including the deterioration of insulators, which takes the form of cracks in the porcelain head.** *Ibid.*, [9] 249–54.—The cracks occur during manufacture; they are then of minute dimensions and cannot be detected by any of the normally applied tests. The crack extends in service during 5 to 10 years; dirt and discharge products deposited in the cracks reduce the resistance of the insulators to a very low value, so that the faulty unit can be detected by field tests and removed. There is no reason to expect the surface characteristics of glass insulators to differ from those of porcelain of the same type. Toughened glass insulators have shown no sign of deterioration in C.E.B. lines at 33 and 132 kv. L.R.B.

Durability of on-glaze decoration. A. J. DALE AND M. FRANCIS. *Tech. Paper Brit. Pottery Research Assn.*, May, 1938; reprinted in *Trans. Brit. Ceram. Soc.*, **41** [10] 245–56 (1942).—The authors review the technical literature on the resistance of on-glaze decoration to attack by acids such as vinegar and hydrochloric, fruit, and food acids and by alkalis contained in soaps and cleansing compositions. R.A.H.

Outdoor bushings—their construction, testing, and standardization. W. A. COOK. *Jour. Inst. Elec. Engrs.* [London], **88** (II) [4] 302–41; [6] 589 (1941).—The degree to which it is practicable to standardize and render interchangeable bushings for outdoor use is discussed. The design and construction of all types, including those of porcelain and glass, are described. L.R.B.

Pottery simplification regulations. ANON. *Clay Prod. News*, **16** [1] 13–14 (1943).—An order of the War Time Prices and Trade Board prohibits Canadian manufacturers from putting handles on semiporcelain-type cups. The varieties of pottery have been cut to 136 items in semiporcelain, vitrified ware, and stoneware. The manufacture of decorated ware is prohibited, and no manufacturer

may acquire any mold or artificial pigment or coloring agent not in his possession or under his control at the effective date of the order. There are 40 permitted items of semiporcelain ware, 52 of stoneware, and 41 of vitrified ware. G.A.K.

Results of investigations of porcelain manufacture with Mysore raw materials. N. V. RAGHUNATH. *Trans. Indian Ceram. Soc.*, **1** [2] 85–90 (1942).—Physical properties of six porcelain body compositions with various proportions of kaolin, feldspar, and quartz from Mysore are reported. P.S.D.

South African pottery. ANON. *Chem. Age* [London], **48** [1227] 3 (1943).—The South African whiteware industry, which has been in abeyance since 1914, has just been restarted by the Consolidated Rand, Brick, Pottery and Lime Co. at Olifantsfontein. Local raw materials will be used, including kaolin from the Rand and Namaqualand, ball clay from Olifantsfontein, spodumene (a glazing flux) from Namaqualand, and quartz from the Transvaal. Ample skilled labor is available. A.B.S.

Vitrified cordierite bodies. L. E. THIESS. *Jour. Amer. Ceram. Soc.*, **26** [3] 99–102 (1943).—10 references, 4 figures.

PATENTS

Making spark plugs. C. A. KUSHLER (Champion Spark Plug Co.). U. S. 2,312,103, Feb. 23, 1943 (Oct. 26, 1940).

Manufacture of pottery ware. W. J. MILLER. U. S. 2,310,859, Feb. 9, 1943 (April 6, 1940).

Method and apparatus for the manufacture of pottery ware. W. J. MILLER. U. S. 2,310,858, Feb. 9, 1943 (Nov. 4, 1931; Nov. 2, 1935).

Pottery setter. F. V. WIND (Pacific Clay Products Co.). U. S. 2,314,534, March 23, 1943 (April 7, 1941).

Spark plug. J. A. JEFFERY (Champion Spark Plug Co.). U. S. 2,312,909, March 2, 1943 (March 23, 1942).

Spark plug. G. M. PAULSON. Can. 410,601, Feb. 16, 1943 (Sept. 3, 1941; in U. S. Aug. 21, 1940). Can. 410,602, Feb. 16, 1943 (Sept. 3, 1941, and Aug. 28, 1942; in U. S. Aug. 21, 1940). G.M.H.

Spark plug and method of making. J. A. DORAN. U. S. 2,311,647, Feb. 23, 1943 (May 6, 1940).

Steatite type ceramic material. M. D. RIGTERINK (Bell Telephone Laboratories, Inc.). U. S. 2,313,842, March 16, 1943 (April 3, 1941).—A predominantly crystalline ceramic material consisting essentially of talc, clay, and magnesium oxide fired together in such proportions that they form a composition the constituents of which calculated as oxides fall within a triangular area on a MgO–Al_2O_3–SiO_2 triaxial diagram approximately defined by the points MgO 36, Al_2O_3 4, SiO_2 60; MgO 44, Al_2O_3 7, SiO_2 49; and MgO 30, Al_2O_3 13, SiO_2 57, which ceramic material contains no more than a small amount of alkali oxides.

Terminal for electrical conductors. L. H. SCOTT. U. S. 2,313,774, March 16, 1943 (April 2, 1941). U. S. 2,313,775, March 16, 1943 (April 2, 1941; July 30, 1941).

SEPARATE PUBLICATION

Nepheline Syenite in Low-Temperature Vitreous Ware. C. J. KOENIG. *Ohio State Univ. Eng. Expt. Sta. Bull.*, No. 112, 36 pp. (1942).—The nepheline syenite was obtained from Blue Mountain, Ont. Its use in ceramic products appears to offer a practicable means of vitrifying ware at temperatures perhaps 200°F. lower than those used in present commercial practice without the addition of other auxiliary fluxes. There has been no attempt to substitute it for feldspar in bodies; instead bodies were built around its physical properties. Strontium carbonate makes easier the development of low-temperature glazes, and by the use of this oxide cone 01 glazes can be obtained which contain no zinc oxide. See *Jour. Amer. Ceram. Soc.*, **25** [9] 230–36 (1942). W.D.F.

Equipment and Apparatus

Air-conditioned room insures quality gauges for war work. CHARLES O. HERB. *Machinery* [N. Y.], **49** [4] 192–96 (1942).—The Axelson Mfg. Co., Los Angeles, Calif., produces gauges in an air-conditioned room; this precaution insures that gauges made to specified dimensions in the summertime will be the same as those made during the winter months. The air-conditioned room is 70 x 30 ft., and the height from the floor to the ceiling is 10 ft. The temperature of the room is maintained at 68°F. within one degree the entire year. The humidity, also controlled, does not exceed 50%. Conditioned air is constantly passed through a duct that extends along the ceiling in the middle of the room and discharged through three draftless air diffusers. Outgoing air is discharged through a grill in the wall at one end of the room. Depending upon the temperature of the outgoing air, a thermostat is actuated to operate the air-conditioning system so as to maintain the prescribed temperature. There is a complete change of air in the room every 3 min. Double doors are provided at the room entrance to minimize temperature changes due to air coming in from the outside when the doors are opened and closed. A constant record of the room temperature is kept by a Foxboro temperature recorder. The cooling of the air is effected by a compressor capable of making 25 tons of ice every 24 hr. The refrigerant is Freon. The room has no windows and is enclosed by insulated walls. Light is provided by more than 600 General Electric fluorescent tubes of 40 watts each. The light at the bench is equal to 50 ft.-candles. Artificial lighting avoids strong shadows, which is an advantage in inspection operations. The machines employed in gauge manufacture are described. R.H.B.

Availameter and its use in soil moisture control: I, The instrument and its use. R. B. ALLYN AND R. A. WORK. *Soil Science*, **51** [4] 307–19 (1941).—For use with medium or heavy soil types, an instrument was developed to indicate soil moisture content through the measurement of plasticity or stability. Essentially, it consists of a pair of needles, each 0.160 in. in diameter, which are pressed into the sample core, the power being supplied by a hand grip and transmitted through a hydraulic cylinder whose pressure is indicated on a dial gauge. The resistance in pounds offered to the progress of the needles to a depth of 0.20 in. is termed "soil stability." Field tests in a pear orchard comparing availameter readings with available moisture as determined by the oven-drying method showed satisfactory correlation. Detailed specifications for the design and operation of the instrument are included. **II, Calibration methods.** *Ibid.*, [5] 391–406.—Typical calibration curves and further field studies are presented. V.D.F.

Calibration and control of the supercentrifuge for the fractionation of oil-well drilling muds. S. C. OLIPHANT, C. R. HOUSSIERE, JR., AND GEORGE H. FANCHER. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1530; *Petroleum Tech.*, **5** [6] 7 pp. (1942).—Drilling mud can be an item of great expense on the Gulf coast. To understand the nature of a drilling mud, it is desirable to know the composition and size of the mineral particles present. The supercentrifuge has been adapted to the fractionation of mud, and the calibration and methods of operation and control are discussed. An alignment chart was found useful in this work. Three samples separated showed good agreement between calculated particle size and size measured by the slit ultramicroscope. See "Fractionation . . .," *Ceram. Abs.*, **21** [10] 223 (1942). W.D.F.

Comparison of the Briggs-McLane and the Goldbeck-Jackson centrifuge methods for determining the moisture equivalent of soils. G. M. BROWNING AND F. M. MILAM. *Soil Science*, **51** [4] 273–78 (1941).—Samples of 58 important soil types of the U. S. were analyzed for moisture equivalent by the standard Briggs-McLane method and by the simpler Goldbeck-Jackson method, which employs a regular centrifuge equipped with trunion cups and Gooch

crucibles. The moisture equivalents ranged from 3.9 to 40.9, and the difference between the two methods ranged from −0.9 to +1.9. The values obtained by the Briggs-McLane method were found to be more reproducible than those of the Goldbeck-Jackson method, although the authors believe that a more accurate centrifuge speed control might make the latter method just as consistent. A regression equation is presented to predict the standard-procedure values from the Goldbeck-Jackson values. When the Briggs-McLane equipment is not available, results satisfactory for most purposes can be obtained using the equipment of Goldbeck and Jackson. V.D.F.

Dust-collecting bench. ANON. *Factory Management & Maintenance*, **101** [1] 172 (1943).—A new dust collector filters the dust out, returning the air to the room. It is easily cleaned. See "Integral . . .," *Ceram. Abs.*, **22** [1] 1 (1943). N.R.S.

Electronic photometer. ANON. *Chem. Industries*, **52** [2] 213 (1943).—An electronic photometer designed by the Photovolt Corp. to register low light values is described. It comprises a phototube and a high-gain d.-c. amplifier and is operated from the power line. For measurements in the visible range as well as in the infrared and ultraviolet ranges, the photometer can be furnished with phototubes of various spectral characteristics. It can be applied to measure the light output of luminous paints, fluorescence, ultraviolet absorption of solutions, glass, and plastics, etc. Because of its high sensitivity, it will record thin light beams as in the evaluation of spectrographs, radiographs, and photographic negatives. E.D.M.

Factors influencing the operation of rotary driers. C. O. MILLER, B. A. SMITH, AND W. H. SCHUETTE. *Trans. Amer. Inst. Chem. Engrs.*, **38** [1] 123; [4] 841–64 (1942).—The analysis of the heat transfer in rotary driers involving direct heat only is given. The designer must choose the size, shape, and spacing of the flights with respect to the flow characteristics of the drying material and the diameter of the cylinder, so that the cascading curtains will attain the maximum height and number. Obviously, whatever the size, shape, and number of flights, the charge in the cylinder must be chosen properly to fill them. The amount of the cylinder charge is a function of the feed rate and time of passage. H.E.S.

Foam formation and foam stability: effect of the adsorbed layer. KENNETH G. A. PARKHURST. *Trans. Faraday Soc.*, **37** [10] 496–505 (1941).—P. compares the chief methods of studying foam formation and stability. The "porous septum" method of Foulk and Miller is used in the study of foam formation. A modification is described in which a perforated brass plate replaces the sintered disk and gives results reproducible to 3 to 5%. The time in seconds for the foam to rise to the 50-cm. mark in the tube, θ_{50}, was measured for various concentrations of foam-producing agents. The substances studied were saponin, alkyl sodium sulfates, sodium oleate, commercial melting agents, and gelatin. The surface tension of the solutions was measured for each concentration employed. Conclusions reached are as follows: (1) With most substances there is an optimum concentration for foam formation. (2) In some cases this occurs where surface tension is changing rapidly with concentration. (3) It is not low surface tension per se that insures stability of foam, but the nature of the adsorbed layer giving rise to a lowering of the surface tension. (4) For the formation of a stable foam, a certain amount of cohesion of the adsorbed layer is necessary, loss of cohesion resulting in a deterioration of foaming power. This occurs when molecules of the film have more than one hydrophilic group in such positions as to permit anchorage flat in the surface. (5) With naturally occurring substances, such as saponins and gelatins, foaming properties and surface tension may vary within wide limits, depending on the source. (6) Small amounts of capillarily active impurities can profoundly modify the foaming properties of gelatin solutions, particularly with respect to pH, e.g., ovalbumin appears to be preferentially adsorbed at the surface of solutions of gelatin to the almost complete exclusion of the latter. F.J.H.

Four-electrode resistance method for measuring soil-moisture content under field conditions. N. E. EDLEFSEN AND ALFRED B. C. ANDERSON. *Soil Science*, **51** [5] 367–76 (1941).—Four equally spaced electrodes were inserted in the soil *in situ*, and the resistance between them was measured two at a time. The expression $(R_{1,3} + R_{2,4}) - (R_{1,2} + R_{3,4})$, where the subscripts denote the electrodes between which the respective resistances were measured, was found to be the electrical resistance of the soil independent of the contact resistances between the electrodes and the soil. Tinned iron electrodes were found to give results identical with those obtained by carbon electrodes and are more rugged. High frequency was used to avoid polarization effects. Measurements made at various depths in a Sudan grass and a sugar-beet plot throughout the irrigation cycle are compared with moisture analyses taken by oven-drying samples. V.D.F.

Graphite lubricant. ANON. *Factory Management & Maintenance*, **101** [1] 164 (1943).—A new lubricant made principally of graphite and designed to withstand high temperatures is discussed. N.R.S.

High-speed steel tools tipped by braze-hardening and braze-tempering. B. S. LEMENT AND W. B. KENNEDY. *Machinery* [N. Y.], **49** [4] 201–203 (1942).—The procedure for tipping lathe tools with molybdenum high-speed steel is described, together with the method of braze-tempering in joining surfaces of the shank and the hardened high-speed steel tip. R.H.B.

Improved volumenometer. JOSEPH C. RICHMOND, JOHN B. PETERSON, AND WINSLOW H. HERSCHEL. *Jour. Amer. Ceram. Soc.*, **26** [4] 127–31 (1943).—7 references, 3 figures.

Industrial screening. C. W. H. HOLMES. *Coke & Smokeless-Fuel Age*, **4** [38] 145–47; [39] 170–73 (1942).—Simple geometrical consideration is given to the screening of large particles (such as coke) on flat jigging screens. Very long screens are required to remove almost completely sizes close to the screen aperture. The velocity of approach of the particles is important; the higher the velocity, the larger is the mesh required to pass it. Fine lawns might therefore be replaced by fast-moving, more robust screens. Inclined jigging screens and revolving screens or trommels are also considered, and reference is made to elongated screen openings, all from the aspect of the velocity of approach. L.R.B.

Manufacture of quartz-crystal filters. G. K. BURNS. *Bell System Tech. Jour.*, **19** [4] 516–32 (1940).—Quartz-crystal filters used in modern carrier systems present new problems in manufacturing technique. In the assembly and testing of the filters and in the production of component crystals, coils, and condensers, special factory facilities are required for the accurate measurement of frequency and the control of atmospheric conditions. The manufacture of quartz-crystal plates in particular combines several fields of applied science, including crystallography, precision grinding, vacuum technique, and high-frequency electrical measurement. Inductance coils and fixed and variable condensers for use in crystal filters must consistently meet advanced requirements, especially in regard to stability. The assembly of the components into filters resembles the manufacture of radio receivers, differing mainly because of smaller quantity requirements. Testing equipment must permit rapid shop adjustment and a test of the completed filters with laboratory precision. H.E.S.

Mobile electron microscope. ANON. *Chem. Industries*, **52** [2] 213 (1943).—A simplified electron microscope which is compact and mobile and may be plugged into a regular 110-v. a.-c. circuit is produced by the General Electric Co. It employs electrostatic focusing of the beam of electrons instead of electromagnetic focusing. Other features are the elimination of the need of a water supply and ease in inserting specimens. It has an overall height of 52 in., requires a floor space of 2 x 3 ft., and weighs 600 lb. E.D.M.

Modern instruments in the ceramics laboratory. V. D. FRÉCHETTE. *Jour. Can. Ceram. Soc.*, **11**, 44–48 (1942).—

F. outlines the use of the following instruments in ceramic research: (*a*) The spectrograph is becoming a powerful ally in yielding valuable information on the elemental composition of inorganic materials and finds its greatest use in the determination of trace elements. (*b*) The petrographic microscope can be used for the identification of minerals present, for quantitative analysis of the mineralogical composition by the counting of grains, for the study of the texture of an aggregate with thin sections or polished sections, and for measuring grain size. (*c*) X-ray diffraction is used for the identification of crystal structure and for determining particle size in the submicroscopic range. G.A.K.

Pressure-membrane extraction apparatus for soil solution. L. A. RICHARDS. *Soil Science*, **51** [5] 377–86 (1941).—The various methods for obtaining samples of soil solution are reviewed. A new method is described in theory and in practice. The apparatus consists of a cylindrical pressure chamber; the soil sample is placed in it in contact with a Cellophane diaphragm which forms one end of the chamber and serves as a semipermeable membrane through which the soil solution is forced by the pressure gradient to pass into the receiver. Data for the permeability of Cellophane to water, air, nitrogen, and Na_2CO_3 solution are presented. The progress of solution removal from three different soils is presented for a chamber pressure of 16 atm. R. discusses possible applications of the method. V.D.F.

Recent developments in laboratory apparatus and instruments. WILLIAM B. WARREN AND HOWARD DRAVING. *Chem. Industries*, **51** [4] 544–48 (1942).—The types of apparatus described include spectrographs, a new microbalance, electrometric titration apparatus, the electron microscope, various types of heaters, a surface analyzer for measuring roughness of paint surfaces, etc., Pyrex brand fritted ware, Vycor brand glass, apparatus for measuring the dissolved oxygen content of boiler feed water to one part in 4 billion, a hardness tester to determine the resistance of surface finishes to abrasion, colorimeters and spectrophotometers, improved types of ovens including those with a uniform temperature throughout, mullite mortars and a mortar grinder that eliminates manual grinding of ores, etc., and plastic and glass tubing to replace rubber for laboratory purposes. 8 illustrations. E.D.M.

Relation of shape to the passage of grains through sieves. GORDON RITTENHOUSE. *Ind. Eng. Chem., Anal. Ed.*, **15** [2] 153–55 (1943).—Microprojection measurements on a natural stream sand showed that 30 to 50% of the grains retained on sieves of a $\sqrt{2}$ series had intermediate diameters larger than the rated openings of the next largest sieve. The effective size of the sieve openings, therefore, as measured by the intermediate grain diameters, was considerably larger than the rated size of the openings. The passage of these oversize grains through the sieves was thought to be due mainly to two factors: (1) the relative importance of the few oversize holes in the sieves and (2) the passage of flattened grains diagonally through the sieve openings. R. presents some data on the quantitative importance of these two factors and outlines several types of investigations in which shape-calibrated sieves can be used advantageously. Illustrated. F.G.H.

Reproducibility of pH measurements with glass-electrode hydrogen-ion meters. R. U. BONNAR. *Jour. Assn. Official Agr. Chemists*, **25** [4] 973–80 (1942).—B. describes a study made in several laboratories of the Food and Drug Administration to estimate the comparability of pH measurements. Seven samples were carefully prepared, and all weighings were made to 0.3 mgm. or less. The hydrated salts showed no evidence of loss of moisture during weighing. The samples were coded in sets for each laboratory so that no two laboratories would measure them in the same order. It was found that all operators secured convergence to 0.01 pH in the measurements, even with samples which were poorly buffered. Temperature-sensitive systems may yield discrepancies up to 0.3 pH under the range of conditions existing among several laboratories. Systems permitting consistent measurements should show mutual agreement within ±0.05 pH. G.A.K.

Sedimentation tube for analyzing water-stable soil aggregates. R. E. MOORE AND R. W. KONG. *Soil Science*, **51** [3] 181–88 (1941).—The sedimentation tube described is a modification of that of Cole and Edlefsen and differs from it in the provision of additional outlets (along the longitudinal axis on 2-in. centers) for drainage and in other details for convenience of operation. An arrangement of siphons is used to control the drainage of the tube. The modified form shows smaller errors, and the time required for analysis is cut to one-tenth. V.D.F.

Sieves for coarse aggregates. A. H. D. MARKWICK. *Jour. Soc. Chem. Ind.* [London], **59** [5] 88–92 (1940).—Comparative tests were made on woven-wire and perforated-plate sieves ranging in size from $^1/_8$ in. to $^3/_8$ in. Woven-wire sieves were found to be considerably less accurate in aperture size and shape than perforated-plate sieves throughout the range of size examined. The sieve sizes were compared from shadow photographs. A woven aperture had an effective size larger by about 4% than a perforated plate of equal projected size due to the geometry of the woven sieve. This effect was demonstrated by passing stones graded on plate gauges into narrow ranges through both types of sieve built with 0.950-in. projected openings. Comparative tests on $^3/_8$-in. woven and perforated-plate sieves were then carried out with hand-gauged hard stones. The effective sizes were analyzed, and the difference between the effective and the average sizes of aperture was accounted for by correcting for the effect of woven-aperture geometry and by making an allowance for the variability in aperture size. If woven and perforated-plate sieves are mixed in carrying out a grading, therefore, discontinuities will occur, resulting in serious errors. It is suggested that sieves of all sizes down to and including $^3/_{16}$ in. be of perforated plate. This is also the accepted division between coarse and fine aggregates. L.R.B.

Simple automatic and recording balance. N. W. MULLER AND R. E. PECK. *Ind. Eng. Chem., Anal. Ed.*, **15** [1] 46–48 (1943).—The authors describe the design, construction, and operating characteristics of a simple, rugged, automatic recording balance which may be constructed in the average laboratory workshop. The instrument is suitable for most of the chemical engineering laboratory operations where a continuous record of sample weight is desired over long periods. Illustrated. F.G.H.

Sticky-surface concentration of gravel-size minerals. JOHN DASHER, JAMES NORMAN, AND O. C. RALSTON. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1537; *Mining Tech.*, **6** [6] 6 pp. (1942).—The purpose was to develop a method by which difference in wettability may be used to separate minerals up to 2 in. in size. War work has stopped further development. After several trials, a frustum of a cone was used; it was rotated on a horizontal axis and submerged in water up to its axis. The inside was coated with cup grease, a thin layer for 10-mesh and $^1/_4$ in. for $2^1/_2$-in. feed. The feed was filmed with a cationic flotation agent and fed into the small end of the revolving cone, which was kept revolving until the non-adhering particles were washed out; the small end was then put into a bucket, and the adhering particles were washed out with a jet of water. Successful separations were made on limestone-granite mixes, feldspar quartz, kyanite quartz, and barite quartz; almost perfect results were obtained in concentrating limestone, feldspar, barite, and phosphate. Fluorite would have to be separated from calcite and quartz in two steps. Quartz could not be separated from phosphate. In a continuous concentrator the adhering particles must be removed by softening the grease in a gas flame, and a method of applying more grease and smoothing it out must be developed. W.D.F.

Temporary transparent coating to protect finished surfaces. ANON. *Machinery* [N. Y.], **49** [4] 204 (1942).—A transparent removable coating for metal and ceramic surfaces, known as "Protektol," has been developed by the Ault & Wiborg Corp., Cincinnati, Ohio, to reduce the

number of products rejected because of rust, surface scratches, shop wear, grease, and dirt. As it is transparent, the new coating permits visual inspection of the parts besides affording protection during handling, fabrication, shipping, storage, and installation. R.H.B.

Waste heat drier. L. R. WHITAKER. Presented at meeting of American Ceramic Society, Cincinnati, April, 1942; abstracted in *Brick & Clay Record*, **100** [5] 33 (1942).

SEPARATE PUBLICATIONS

Active List of Permissible Explosives and Blasting Devices Approved Prior to June 30, 1942. *U. S. Bur. Mines Repts. Investigations*, No. 3665, 25 pp. (1943). Free.—This report gives 194 brand names of permissible explosives and blasting devices now on the active list. R.A.H.

Industrial Instruments for Measurement and Control. THOMAS J. RHODES. McGraw-Hill Book Co., Inc., New York, 1942. 573 pp. Price $6.00. Reviewed in *Chem. Industries*, **52** [2] 213 (1943).—The book is intended as a formal textbook and as a practical reference for those concerned with instrumentation and automatic control in industry. The basis of the work is the theories and applications of instrument control rather than descriptive material on all available types of controls. The four fundamental physical and thermal quantities encountered by the chemical engineer in industrial processing and manufacture, viz., temperature, pressure, fluid flow, and liquid level, are considered first, followed by the engineering details underlying the design and construction of pressure and vacuum gauges, indicating and recording thermometers, high-temperature pyrometry, the theory of differential-pressure flowmeter primary measuring instruments, differential-pressure flowmeter secondary measuring, recording, and integrating elements, miscellaneous inferential and volumetric flowmeters, liquid level measurement, telemetering, automatic-control theory, and automatic control mechanisms. Representative industrial instruments that have special applications, such as the continuous CO_2-gas analyzer, pH meters, etc., are described. E.D.M.

PATENTS

Apparatus for examining quartz. P. D. GERBER (Radio Corp. of America). U. S. 2,313,143, March 9, 1943 (May 31, 1939; July 31, 1940).

Automatic-feed weighing apparatus for granular, pulverulent, and like fluent solid materials. AVELING-BARFORD, LTD., AND G. V. V. HUTCHINSON. Brit. 550,-368, Jan. 20, 1943 (Sept. 26, 1941).

Batch charger. BERT NOBLE. U. S. 2,310,592, Feb. 9, 1943 (March 29, 1941).

Dust recorder. VERNER DAHLMAN AND ARTHUR NUTTING (American Air Filter Co., Inc.). U. S. 2,312,295, Feb. 23, 1943 (July 25, 1941).

Feeding apparatus for plastic material. W. H. EMERSON AND W. C. DENISON, JR. U. S. 2,313,056, March 9, 1943 (March 9, 1940).—Continuously operating clay-feeding apparatus comprising a pair of pistons, each adapted to be connected to the back of a plunger, a hydraulic cylinder housing each piston, a pump for pumping liquid into the cylinders behind the pistons to force them ahead, a valve for connecting the pump alternately with each cylinder, means for maintaining the pump operating at a constant pressure to deliver the liquid to the cylinders at a uniform rate, and means actuated by the increase in hydraulic pressure behind a piston that has reached the forward limit of its stroke for tripping the valve to connect the pump with the other cylinder.

Gyratory screen. W. J. PARKS. U. S. 2,313,765, March 16, 1943 (Sept. 7, 1937; Oct. 22, 1940).

Scratch resistance testing machine. N. J. BENO (Continental Can Co., Inc.). U. S. 2,311,430, Feb. 16, 1943 (Jan. 14, 1941).

Kilns, Furnaces, Fuels, and Combustion

Analysis and testing of coal in relation to its properties and utilization. Melchett lecture. ARNO C. FIELDNER. *Jour. Inst. Fuel*, **16** [86] 5–20 (1942).—A review of the high lights of thirty-five years' of coal testing and research in the U. S. Bureau of Mines is given. The studies involved coal petrography and hydrogenation as well as coal-ash fusibility, viscosity, and clinker formation; gas, coke, and by-product making; and the plastic properties of coal. H.E.S.

Contact nonlinearity with reference to the metal rectifier and the Carborundum ceramic nonlinear resistor. A. FAIRWEATHER. *Jour. Inst. Elec. Engrs.* [London], 89 (I) [23] 499–518 (1942).—The laws governing the behavior of nonlinear contact resistances in electric circuits are reviewed and investigated. The results do not conflict with the "barrier-layer" hypothesis. L.R.B.

Control of the physical properties of clinker by various additions to the coal. A. C. DUNNINGHAM AND E. S. GRUMELL. *Jour. Inst. Fuel*, **15** [80] 23–25 (1941).—The addition of sand to a coal gives a more open and friable clinker in which the sand particles are loosely cemented together by the fusible material. This insures a better distribution of air through the fuel bed and a higher net burning rate. The quantity of sand required is related to the quantity of fusible material in the ash. H.E.S.

Direct radiant kiln firing in the ceramic industry. HARRY W. SMITH, JR., AND J. A. EHLINGER. *Jour. Amer. Ceram. Soc.*, **26** [4] 132–36 (1943).—11 figures.

Dustless treatment of coals. R. E. SHERMAN AND G. W. LAND. *Combustion*, **14** [9] 48–49 (1943).—The application of calcium chloride to coals of varying porosity is discussed. The permanence of treatment in relation to the amount applied and the effectiveness of mixtures of Clarion extract with calcium chloride are pointed out. Preliminary data on the problem of corrosion and on the freezeproofing of coal are given. H.E.S.

Flame temperature of gases. ANON. *Coke & Smokeless-Fuel Age*, **4** [33] 29–32 (1942).—The calculation of the theoretical flame temperature of industrially important gases is discussed (with the American Gas Assn. Handbook as a guide), and a table is given of flame temperatures taken from several sources and of some newly calculated temperatures. L.R.B.

Flat arch tunnel kiln. ANON. *Brick & Clay Record*, **101** [6] 44–46 (1942).—The desirable features of a Ladd circular tunnel kiln constructed with a flat arch at the Goose Lake plant of the Illinois Clay Products Co. are discussed. B.C.R.

Gas movement in regenerative furnaces. E. J. GOODING AND M. W. THRING. *Iron & Coal Trades Rev.*, **145** [3898] 1127–30 (1942).—Formulas are developed for calculating the magnitude of gas pressure and distribution of the pressure over the furnace section and length, causing the flow of gas through the furnace and regenerative system. See "Flow . . . . ," *Ceram. Abs.*, **21** [6] 129 (1942). M.HA.

Gas sampling and temperature measurement in fuel beds. L. H. F. NICHOLS. *Jour. Inst. Fuel*, **14** [75] 71–73 (1940).—The object of fuel-bed investigations is to elucidate the phenomenon of combustion for better design and more efficient working of the plant. Apparatus and means for taking gas samples and measuring temperatures at desirable positions in the fuel bed are described. H.E.S.

How can the laws of statics be made applicable to the design and development of furnace arches? G. NEUMANN. *Arch. Eisenhüttenwesen*, **15** [10] 437–45 (1942).—The application of statics in the mechanical design of furnace structures and furnace arches in all its details is explained and illustrated by examples. M.HA.

Influence of storage on caking and coking properties of coal. L. D. SCHMIDT, I. L. ELDER, AND J. D. DAVIS.

Ind. Eng. Chem., **35** [2] 150–55 (1943).—Samples (400 lb.) representative of fifteen coal beds were oxidized progressively in an accelerated weathering apparatus and then subjected to a series of tests for the purpose of following the changes in various aspects of their coking and caking behavior. The length of time each coal could withstand standard oxidizing conditions before losing its coking power (termed "durability of coking power") showed a sixteenfold range among the coals tested. The durability of coking power of most coals can be predicted with fair accuracy from their analysis by the method developed. Loss in caking tendency (leading to improved performance in underfeed stokers) was followed by several different tests. Comparisons showed that (1) a decrease in agglutinating value predicts decreased strength of coke and (2) the amount of unfused char remaining in the retort after carbonization can be correlated with the strength of coke and also with the agglomerating index that is based upon the classification of coke buttons made in the standard volatile-matter test. The caking tendency of coals can be reduced greatly by storage or oxidation long before the true loss in heating value exceeds 1 or 2%. Illustrated. F.G.H.

Low-temperature coal-gas plants. D. T. DEO. *Trans. Indian Ceram. Soc.*, **1** [2] 123–29 (1942).—The history of coal carbonization is reviewed. The main features of workable plants for low-temperature carbonization are discussed briefly, and the following products of carbonization are considered: (*a*) low-temperature gas, (*b*) low-temperature coke, (*c*) low-temperature tars. Retort materials are discussed with special emphasis on metal retorts and their advantages for low-temperature carbonization practice. P.S.D.

Normal burning of gaseous explosive mixtures. ERNEST F. FIOCK. *Sci. Monthly*, **52**, 216–32, 349–58 (1941).—F. reviews the principal elements upon which recent studies of the combustion process are based. Progressive flames in normal burning, i.e., burning in the absence of detonation, are discussed. Illustrated. H.E.S.

Novel two-stage combustion process. F. ALTON. *Eng. & Boiler House Rev.*, **57** [1] 18–21, 31 (1943).—To develop a combustion system entirely free from slagging and capable of burning almost any kind of fuel within a fraction of the specific furnace space required today, a two-stage combustion process was devised by G. Szikla and A. Rozinek which consists in gasification of the coal and combustion of the gaseous fuel in separate stages. An actual installation is described in detail: gasification of coke and simultaneous liquid slag removal are carried out in one furnace chamber having a temperature of 2370° to 2520°F., and the gas is burned in the second chamber where a temperature of 1920° to 2210° is said to give optimum results. In chamber 1, a high CO and low CO_2 percentage exists which produces perfect combustion in chamber 2. A special type of water-cooled furnace chamber was developed for resisting the high temperatures in chamber 1. M.HA.

Physical processes in a bed of fuel. J. G. BENNETT. *Jour. Inst. Fuel*, **14** [74] 47–62 (1940).—An attempt was made to examine the processes in a fuel bed from the standpoint of energy, in order to specify the ideal conditions for a given purpose. The actual temperature, on which the rate of gas-making reaction depends, must be a maximum, while the theoretical temperature, which depends upon the extent to which gas-making reactions have proceeded, should be a minimum. Wall heat loss can be reduced by keeping the gas flow from the walls by fuel segregation, nonuniform packing, nozzle inlets, or wall insulation. Reactivity of the fuel accelerates the conversion of sensible to chemical heat. Its effect is therefore most marked when the bed is thin or the wall heat loss is great. As the temperature is limited in practice by ash, steam may be desirable in excess of the theoretical value. Reduction of the peak CO_2 by the use of a very small fuel is desirable, as this is equivalent to removing the part of the bed in which the worst ash problem occurs. These results can be applied similarly to other fuel beds. It is possible to design a crucible-heating furnace in which maximum use is made of the fuel energy by arranging the surface of the maximum CO_2 from a number of inlets to coincide with the surface of the crucible. H.E.S.

Physical properties and physical structure of coals. C. G. CANNON. *Jour. Inst. Fuel*, **16** [87] 51–60 (1942).—For coals, as for other mixtures, chemical constitution, density, and refractive index are closely related. Substances of different chemical constituents and structure give differently shaped dispersion curves. The fact that coals of varying rank give parallel dispersion curves indicates that the structure of the refracting micelles changes very little with rank. This conclusion is in agreement with the X-ray evidence for a graphitelike lattice, which also changes little with rank. The optical results are in agreement with the observed X-ray results. They indicate that in low-rank coals the micelles are oriented at random and separated by volatile matter. The optical anisotropy indicates a preferred orientation of the micelles with the "carbonhexagon" layer planes becoming more and more parallel to the bedding plane, the more condensed network of atoms in a direction perpendicular to the bedding plane giving the higher refractive index in that direction. The data so obtained are proposed as a basis for the correlation and classification of coals. H.E.S.

Refractory concrete for kiln crowns. ANON. *Brick & Clay Record*, **101** [5] 50 (1942).—Refractory concrete has proved satisfactory for use in kiln-crown construction in a rectangular, downdraft, end-fired kiln operating at a maximum temperature of 2100°F. installed at the Eureka Fire Brick Works, Mt. Braddock, Pa. B.C.R.

Selection of fuels for underfeed stokers. ANON. *Claycraft*, **16** [5] 175–76 (1943).—Certain physical factors which affect mechanical stokers are as follows: (*a*) upper size limit, which for stokers up to 75 lb. per hr. should be 1 in.; up to 150 lb. per hr., $1^1/_2$ in.; up to 275 lb. per hr., 2 in.; and over 275 lb. per hr., $2^1/_2$ in.; (*b*) caking properties, which can be high if the coke bed is periodically broken up by the fireman; and (*c*) proportion of fines, which is determined by the caking power of the coal and by the furnace conditions. For stokers up to 100 lb. per hr., 25% of 8-in. mesh can be used with noncaking coal and 40% with moderate caking coal; for stokers over 100 lb. per hr., 30% of 8-in. mesh can be used with noncaking coal and 50% with moderate caking coal. Welsh steam coals running 13/16% volatile can be burned with excellent result, but anthracite should be mixed with 50% bituminous coal. Certain semianthracite and hard steam coals give good results when used straight. Straight gas coke or low-temperature coke may be used in existing stokers, but it is preferable to mix it with 50% bituminous to reduce wear to a minimum. G.A.K.

Stability and structure of burner flames. B. LEWIS AND G. VON ELBE. *Jour. Chem. Phys.*, **11** [2] 75–97 (1943).—It has been shown that the condition of equality of gas and burning velocities, required for stabilization of a flame above a burner, is established near the rim of the orifice or an obstruction within the stream by the effects of friction and inhibition of the explosive reaction. This condition is maintained between two critical gradients of the gas velocity at the solid surface, the lower gradient bordering on the flash-back and the upper gradient on the blow-off range. Values of the gradients in the range of laminar flow were determined by hydrodynamic equations from gas flow and tube dimensions; their independence of tube diameter, except for extreme sizes, has been demonstrated both for upright and inverted flames. In the latter, the critical velocity gradient for blow-off was found to be independent of the diameter of the centrally mounted wire within a considerable range. The effect of the surrounding atmosphere on the critical blow-off gradient has been shown. The gas-flow pattern was studied experimentally by photographing stroboscopically illuminated magnesium oxide particles. No appreciable redistribution of velocities over the cross section of the stream was observed below the combustion zone. The burning velocity was found constant over the surface of the inner cone, except at the tip, where it increases to the axial gas velocity, and at the base, where it decreases to zero. The

experimental flame cone outline and flow pattern agree with the theoretical within the limitations imposed by simplifying assumptions. The temperature distribution in the flame was determined by the sodium line-reversal method, only the center of the flame being colored, and observations of the width and emission spectrum of the luminous combustion zone were made. In natural gas-air flames, C—C and C—H bands are observed in the zone, and the temperature rises gradually behind the zone to a maximum that corresponds to the theoretical flame temperature. In natural gas-oxygen flames, no C—C or C—H bands are observed, and the temperature attains a maximum, exceeding the theoretical, immediately behind the combustion zone. Temperature distribution and flow pattern of inverted flames were also studied with particular attention to the region of flame attachment just above the central wire, where the formation of an annular vortex is demonstrated. An interpretation of the formation of polyhedral flame cones, described by Smith and Pickering, is given. G.A.K.

Storage of coal for industrial purposes. R. A. A. TAYLOR. *Jour. Inst. Fuel*, **14** [77] 144–47 (1941).—The rate at which a coal deteriorates depends upon the size. Large coal deteriorates more slowly than small coal of the same kind. Deterioration occurs most rapidly during the first 3 to 12 months' storage, and then the rate falls off considerably. The more a stored coal heats, the more deterioration occurs, and this results in a decided loss in coking power; otherwise the deterioration is more or less insignificant. H.E.S.

Underfeed stokers on round downdraft kilns. ERNEST B. MERRY, JR. Presented at meeting of American Ceramic Society, Cincinnati, April, 1942; abstracted in *Brick & Clay Record*, **100** [5] 31 (1942).

What's happening inside your kiln? VIII, Water-smoking (continued); IX, Oxidation. L. R. WHITAKER. *Brick & Clay Record*, **101** [4] 21–22; [5] 26, 28 (1942).—W. discusses the oxidation of combustible matter in clays, especially carbonaceous shales, in the water-smoking and oxidation periods. The removal of carbon is a function of (1) setting, (2) thickness of the ware, (3) fineness of the ware, (4) graduation of temperature schedule, (5) draft, (6) distribution of draft, (7) kiln atmosphere, and (8) type of carbon. **X, Heat distribution.** *Ibid.*, [6] 22–23.—W. lists eight factors to be considered in designing an ideal furnace for a kiln. The advantages and disadvantages of a small furnace are compared with those of a large one. Considerable savings in fuel and time can be obtained with a large furnace, but greater care must be exercised in its operation to prevent overfiring. **XI, Furnaces.** *Ibid.*, **102** [1] 38, 40, 42 (1943).—W. discusses the construction of the furnaces or fireboxes of a kiln in relation to the effect on the refractories, to the operating efficiency in firing, and to the draft used. **XII, Air leakage in kiln.** *Ibid.*, [2] 23–25 (1943).—Air leakage in a kiln may occur through holes in the fuel bed, in the kiln wall, or in the door. The greater the draft on a kiln, the more cold air will short-circuit into it and flow to the bottom of the kiln. Air leakage through the fuel bed may be due to (1) too high a firing bridge, (2) insufficient ash depth, and (3) excessive clinkering. Higher and tighter bag walls facilitate better mixing of hot and cold gases. Air leakage through kiln walls, which is greater than is generally realized, may be reduced by (1) a tighter wall construction, (2) grouting the inside wall, (3) construction of an independent outer wall, so built that air leaking through must flow to the top of the crown before entering the inside of the kiln (a continuous bag wall accomplishes the same purpose), (4) sweeping the outside of the kiln with a cement grout, and (5) use of an airtight steel shell around the kiln. For Parts **I, VI,** and **VII** see *Ceram. Abs.*, **22** [3] 57 (1943). B.C.R.

PATENTS

Device for automatically indicating breakdown in kiln conveyers. VICTOR GRANDITZ. U. S. 2,313,638, March 9, 1943 (Dec. 20, 1941).

Firing ceramic ware. A. H. FESSLER AND A. P. WATTS (General Motors Corp). U. S. 2,310,578, Feb. 9, 1943 (Aug. 2, 1940).—The method of firing ceramic ware held together by a temporary oxidizable binder adapted to be driven off prior to the sintering or vitrifying of the ware comprising passing the ware successively through a preheating chamber, a firing chamber, and a cooling chamber, subjecting the ware to the direct action of hot combustion gases in the firing zone, causing the products of combustion to pass outwardly from the firing zone through the preheating zone to initially heat the ware and drive off the binder, the products of combustion constituting substantially the entire atmosphere in the preheating zone, and further reducing the uncombined oxygen content in the preheating zone to prevent disruption of the ware by too sudden elimination of the binder.

Kiln. J. H. MINTER. U. S. 2,314,507, March 23, 1943 (Sept. 2, 1941).

Geology

Accurate wet combustion method for determination of carbon in soils. PAULINE ALPER. *Jour. Agr. Sci.*, **32** [4] 389 (1942).—A refinement of the apparatus described in a previous paper (*Ceram. Abs.*, **18** [1] 35 (1939)) is given. P.S.D.

Aluminum-bearing scorodite from Hobart Butte, Oregon. REYNOLDS M. DENNING. *Amer. Mineralogist*, **28**, 55–57 (1943).—Hobart Butte is in Lane County, $2^1/_2$ miles northwest of Blackbutte Mine Post Office. The upper part of the hill is composed of altered andesite tuff, which is quarried for the clay it contains. Here is found the scorodite; it is light green. Optically it has $\alpha = 1.712$ and $\gamma = 1.728$. The spectrograph shows Fe, As, and Al; no other lines were noted. Calculation of the percentage of Al_2O_3 from the difference in the refractive indices of this and pure scorodite shows about 7% Al_2O_3. W.D.F.

Amblygonite. CHARLES PALACHE, W. E. RICHMOND, AND C. W. WOLFE. *Amer. Mineralogist*, **28**, 39–53 (1943).—Two new occurrences of amblygonite at Hebron and Newry, Maine, furnished measurable crystals. Those at Newry were very large, one being 11 cm. long. New elements based on X-ray study required a different orientation from that of Dana. The cell contains 2($LiAlPO_4(OH,F)$). The new angle table contains, besides the forms known previously, 10 new forms. W.D.F.

Barium feldspars (celsian and paracelsian) from Wales. L. J. SPENCER. *Mineralog. Mag.*, **26** [178] 231–45 (1942).—Paracelsian and celsian have the same empirical formula, $BaAl_2Si_2O_8$, but distinct optical and X-ray characteristics; the former are fully described. A historical survey of barium feldspars is appended. L.R.B.

Barytes deposits of Orchha State, Central India. V. S. DUBEY. *Trans. Indian Ceram. Soc.*, **1** [2] 108–11 (1942).—The geology and prospects of the deposit are reported and discussed. P.S.D.

Berea sandstone of the Cleveland (Ohio) area. PHYLLIS A. WEIDMAN. *Ohio State Univ. Eng. Expt. Sta. News*, **14** [5] 14–21 (1942).—The Berea sandstone is of lower Mississippian age. It outcrops in a north and south band through central Ohio, and its thickness varies from 0 to over 225 ft. This rock is coarse grained and always gritty, owing to small amounts of cement that prevent glazing. Its crushing strength averages 9000 lb. per sq. in., while its modulus of rupture is about 750, specific gravity about 2.1, and porosity about 16%. It is buff to yellow where oxidized and blue-gray otherwise. The sand grains are principally quartz and chalcedony with smaller amounts of feldspar, clay, etc. It also contains small amounts of muscovite, sericite, chlorite, schorlite, zircon, ankerite, and pyrite. The bond is amorphous silica, the films averaging 2 μ thick; it is probably chalcedony. Chemical analysis shows about 93% SiO_2 and 3% Al_2O_3. This sandstone has been used for grindstones for over 100 years and is still considered superior for some purposes.

Firestone blocks for refractories now account for two-thirds of the business; they are considered equal or superior to artificial silica brick. Other uses include building, curbing, flagging, and riprap. W.D.F.

Between the lines: fluorspar. ANON. *Chem. Industries*, **52** [1] 39 (1943).—A discussion of the present and possible new sources of supply, uses, and price of fluorspar is presented. The metallurgical grade is the most used, being employed in the steel industry to increase the fluidity of the molten slag. It is also used in the manufacture of aluminum, refrigerants, 100-octane gasoline, hydrofluoric acid, and ceramics. The ceramic grade is used by pottery manufacturers, particularly in the manufacture of lavatory equipment. An exceptionally pure grade of fluorspar is used in the manufacture of optical glass. Kentucky and Ohio are the chief producers, but exploration is now being carried out in New Mexico, Colorado, and Utah. E.D.M.

Brazilian quartz. PAUL F. KERR. *Mining & Met.*, **23** [427] 374–75 (1942).—Quartz crystals are essential to radio communication. Tourmaline and Rochelle salt can be used but have not proved satisfactory. Although commercial quartz crystals occur in Madagascar, Alaska, and the U. S., Brazil is the chief commercial source. The crystals, occurring in a matrix of deeply weathered clay, require considerable hand sorting; one good crystal may be obtained to 4000 rejected. A crystal weighing one-half ton was obtained recently. B.C.R.

Chromite. G. A. ROUSH. *Mineral Ind.*, **50,** 59–72 (1941).—The loss of Greece, Yugoslavia, and the Philippines through occupation by the Axis powers has resulted in a potential loss to the Allies of 300,000 tons of chrome ore per year. Brazilian production (1941) amounted to 4579 metric tons, of which 4064 tons were shipped to the U. S. and 508 tons to Germany. Cuban exports to the U. S. amounted to 111,529 long tons for the first 9 months of 1941, compared with 51,955 tons for 9 months of 1940. Indian chromite production, although amounting to 50,000 to 60,000 tons, is somewhat inaccessible because of shipping difficulties. All exports of South African ore, amounting to 117,400 short tons for 9 months of 1941, were sent to the U. S. Imports by the U. S. of Southern Rhodesian ore were 163,933 long tons. Great Britain and France had contracted for all Turkish ore up to Jan. 8, 1943 (see *Ceram. Abs.*, **22** [1] 20 (1943)). Actual exports of ore have been very low, being 29,524 metric tons from Jan. to May, compared with 70,178 tons for the same period of 1940. B.C.R.

Clay from Banda District. H. N. ROY AND M. L. MISRA. *Trans. Indian Ceram. Soc.*, **1** [2] 67–71 (1942).—Chemical analyses, mechanical analyses, microscopic studies, and physical properties of fired trials are reported on two varieties of a white-firing clay occurring in the Banda District of the United Provinces. Tests of earthenware and porcelain trials using this clay as a body material are also reported. P.S.D.

Determination of the moisture equivalent by the silt-suction method and the shifting of the pF curve of the stored soil samples. J. V. BOTELHO DA COSTA AND J. ALMEIDA ALVES. *Jour. Agr. Sci.*, **32** [3] 294–97 (1942).—The relative unreliability of Bouyoucos's method for moisture-equivalent determinations is a consequence of (1) a variation of the suction force maintained with the nature of the soil and (2) poor reproducibility of results. Constant and equal suction force for all soils is secured by Schofield's silt-suction method. It was found that the pF curves of stored soil samples may shift considerably with passage of time. In the samples studied, the pF at the moisture equivalent has dropped from 2.9 to about 2.4 in a period of 7 years. In view of this shifting, the reliability of the silt-suction method for moisture-equivalent determinations has not been definitely ascertained by the experiments reported. P.S.D.

Diatomite. V. L. EARDLEY-WILMOT. *Mineral Ind.*, **50,** 189–94 (1941).—Data on the deposits, mining, preparation, uses, and prices of diatomite are given for 1941. B.C.R.

Dispersion studies on Gezira soil. T. N. JEWITT. *Jour. Agr. Sci.*, **31** [4] 466–78 (1941).—The degree of dispersion on shaking of the heavy clay Gezira soil was studied in relation to its initial moisture content when it is added to the water. A minimum dispersibility was found at about 7% initial moisture content. Such behavior is different from that found for certain English soils by Puri and Keen. Spontaneous dispersion was studied using the same soil, and by this method it was found that the dispersion decreases with increasing moisture content over the range of 0 to 9% moisture. This relation between dispersion and water content is discussed in regard to possible effects in the field of practice. Attention is called to possible seasonal and daily differences in the effect of rainfall. P.S.D.

Domestic sources of barytes. W. D. REYNOLDS. *Chem. Age* [London], **48** [1233] 197–99 (1943).—No two deposits are exactly alike, and expert examination and chemical analyses are imperative before correct mining instructions can be given and adjustments made to processing plants. Present-day refining methods for barytes are more or less standardized but fail to produce quality results. Differences in quality of the product are almost entirely governed by differences in the quality of the raw material. Advanced technique is essential if a high degree of purity and low cost of manufacture are to be effected. Expert diagnosis can determine the use to which individual types and their associated impurities are best suited. Varieties of barytes which are wastefully employed in the production of off-color products, particularly in the manufacture of barium salts, blanc fixe, lithopone, etc., if subjected to modern treatment, would produce a finely milled pure white product at low cost suitable for paint and other industrial uses and competitive to blanc fixe. It is important when mixing not to include impure material with the best quality. Some material, being stained throughout, cannot be used to produce the whitest grades. The proper mechanical treatment is of the utmost importance if excessive costs are to be avoided. The plants should be automatic with minimum labor requirements. Costs per ton can then be largely a question of horsepower-hours and the amount of chemicals consumed per ton of ore. If barytes is to be competitive in American markets, a pure white finely milled powder must be manufactured. Barytes requires less shipping space per ton than many other lighter and more bulky exports. It is cheap to manufacture, yet commands a high sale value. A.B.S.

Feldspar grinding plant in Tennessee. A. H. HUBBELL. *Eng. Mining Jour.*, **143** [12] 67–68 (1942).—This plant is in Unico County, northeastern Tennessee, and it uses feldspar from the Spruce Pine district in western North Carolina. The feldspar first passes a grizzly with a 1-in. opening and a Reliance crusher set to $1^1/_2$ in. and then goes to a bin. It is then fed to a secondary crusher and a double-deck screen. From here on its treatment depends on what is to be done with the material, as a flexible flowsheet allows a wide variety of products. There are eight magnetic separators. There are about ten different sized products, and in addition 50 to 60 chemical grades are made. The capacity of the mill is several thousand tons per month. W.D.F.

"Flint" ground for abrasives. ANON. *Eng. Mining Jour.*, **143** [11] 55 (1942).—In western North Carolina the United Feldspar & Minerals Corp. grinds vein quartz, locally called "flint," obtained from the pegmatite deposits in which feldspar occurs. Sizes can be varied from 20- to 180-mesh. W.D.F.

Fluorspar. ANON. *Mineral Ind.*, **50,** 195–200 (1941).—Domestic production and prices for 1941 are given. B.C.R.

Kaolin deposit of the Bagru Plateau, Ranchi District, Bihar. H. L. CHHIBBER, M. L. MISRA, AND P. RANJAN. *Trans. Indian Ceram. Soc.*, **1** [2] 94–107 (1942).—The physical features and geology of the deposit are described. The megascopic and microscopic characters, chemical compositions, the shrinkage, porosity, and tensile strength

at various temperatures, and the suspensibility of the kaolin are reported. Prospects for the deposit are discussed. P.S.D.

Laws of soil colloidal behavior: XXIII, Constitution of the pedosphere and soil classification. SANTE MATTSON. *Soil Science*, **51** [5] 407–25 (1941).—M. considers soils as morphological parts of the pedosphere, which he defines as embracing a dispersed system in which material from the lithosphere, the hydrosphere, the atmosphere, and the biosphere alternate as dispersed phase and dispersion medium. A scheme of two-dimensional classification of soils, based on humus content and base status, is described. The main groups are (I) Lithopeds, containing less than 1% organic matter; (II) Humolithopeds, containing 1 to 12% organic matter; and (III) Humopeds, containing over 12% organic matter. Each of these groups is then subdivided according to alkalinity: (1) The supersaturated or alkaline soils, in which $(C + b)/C \times 100 > 100$; (2) the partly saturated or semisaturated soils, in which $(C - H)/C \times 100 = 0$ to 100; and (3) the negatively saturated or acid-saturated soils, in which $(C - H)/C \times 100 < 0$. C, b, and H are determined as follows: The completely electrodialyzed soil is electrometrically titrated to pH 7 with standard calcium hydroxide to give the capacity, C, of the soil to bind Ca at pH 7. The original soil is titrated to pH 7 in the same way; this gives the total acidity, H, which is the sum of the exchangeable hydrogen ions and the free and exchangeable acids. Alkaline soils are washed practically free from salts, and the pH is measured; the amount of base which the soil will bind at this pH is read from the titration curve of the electrodialyzed soil, and this amount is $C + b$. The leached soils are further classified as "anionically solvated and eluviated" or "cationically solvated and eluviated." Anionic solvation occurs with soils having a positive base status, the primary silicates and gel undergoing a basic hydrolysis in which ionized acidoid groups split off and become solvated in association with the exchangeable cations; they may be removed by percolating solutions to leave the lithocol complex poorer in acidoids (chiefly silica). Because the pH normally increases downward, so that the anionic sol complex cannot be precipitated in the lower horizons, such soils show a fairly uniform composition of the colloidal fraction throughout. In the presence of humus acidoids, silica may be partially displaced, and some of the sesquioxides may then undergo an anionic solvation and eluviation. Cationic solvation is associated with oxidation, which raises the acidity, and with the presence of mineral and humus acidoids, the pH at which solvation begins depending on the acidoid-basoid ratio, on the buffer capacity for acids, and on the nature of the acid anions. The cationic sol complex must always precipitate in the lower horizons when it encounters a sufficiently high pH; such profiles are characterized by a higher content of iron and alumina in the B horizon than in the A horizon. The division of soils on the basis of the dominant exchangeable cations is useful. The displacement of the ions takes place according to the mass law, thus depending on the ionic charge and on the activity in the outside solution and the micellar solution. The pH at which the soil binds equal amounts of anions and cations (the equi-ionic point) and the amount combined depend on the nature of the ions and on the acidoid:basoid ratio in the complex. The nearer the ratio approaches unity, the greater will be the amount combined; the lower the ratio and the higher the valence of the anions in relation to the cations, the higher is the equi-ionic point. The soil types and series are classified on the basis of profile characteristics. The limitation imposed on any attempt to confine these to a few type names, grading, as they do, one into another, is avoided by the presentation of a chart making a graded classification possible. Textural varieties of soils are distinguished by the conventional methods of mechanical analysis. The nature of the pedocols, consisting of lithocols and biocols, furnishes an additional basis of classification. The biocols include a continuous series of ampholytoids which range from those having a high I.E P., low acidity, and low base-exchange capacity ("sour" humus) to those having a very low I.E.P., strong acidoid properties, and high base-exchange capacity (mild humus). Lithocols are of at least three kinds: primary silicate particles of colloidal dimensions, secondary minerals, and a heterogeneous gel and sol complex of indefinite composition containing hydrous oxides of Al, Fe, and Si and organic compounds. M. discusses the classification of soils on these bases in relation to soil-forming processes, with examples. 28 references, 5 diagrams. For Part **XXII** see *Ceram. Abs.*, **20** [4] 103 (1941). V.D.F.

Ludwigite from Colorado Gulch, near Helena, Montana. ADOLF KNOPF. *Amer. Mineralogist*, **27**, 824–25 (1942).—This location is 10 miles west of Helena in Lewis and Clark County. Here the Boulder batholith has invaded marbles belonging to the Jefferson formation of Devonian age. Large quantities of a black radially fibrous mineral are exposed, which chemical and optical tests show to be ludwigite, the magnesium-iron borate. It is associated with magnetite. The specific gravity is low for this mineral, showing it to be near the magnesian end of the ludwigite series. W.D.F.

MacIntyre development—new source of titanium. I. D. HAGAR. *Eng. Mining Jour.*, **143** [12] 47–49 (1942); *Mining & Met.*, **23** [432] 594–96 (1942).—This deposit was originally discovered in 1826, and the ore was smelted for iron, but because of the titanium content the company was not successful. It has recently been developed as a source of ilmenite for the production of titanium pigments, as it is impossible to obtain foreign ilmenite. It is located near Lake Sanford in Essex County, New York. The ore body is a segregation deposit of mixed ilmenite and magnetite in an anorthosite country rock. Grinding to minus 20-mesh liberates the ilmenite from the magnetite. Estimated reserves are 15 million tons of ore with 16% TiO_2. Ordinary open-pit methods of mining are used. At the concentrator a jaw crusher does primary crushing, followed by two cone crushers. Screens and conveyers in closed circuit with the crushers send minus $^1/_2$-in. ore to the grinding plant. Four rod mills grind the ore; they are in closed circuit with 20-mesh screens. The ground product goes to a battery of 12 wet-belt magnetic separators, which separate the magnetite from the ilmenite. The magnetite is very low in phosphorus, but it contains 9% TiO_2 and 0.35% vanadium; it may be handled in a blast furnace without serious difficulty. Tailings are classified and sent over tables to produce a rough ilmenite concentrate; this is dried and again separated magnetically; this product has about 48% TiO_2. Out of 4000 tons of ore mined per day, 800 tons of ilmenite and 1600 tons of magnetite are produced. W.D.F. + B.C.R.

Measurements of pore-water pressure in silt and loam. KARL TERZAGHI. *Civil Eng.*, **13** [1] 33–36 (1943).—Limitations of the use of Bourdon gauges, observation wells, or Goldbeck cells in silt and clay are largely overcome by T.'s gauge. It consists of a steel membrane whose deflections are measured by means of a Carlson strain meter connected with a Wheatstone bridge. The least reading on the bridge corresponds to about 1 ft. of hydrostatic head. Fields tests show that the instrument is easy to apply. B.L.

Merwinite as an artificial mineral. J. PHEMISTER. *Mineralog. Mag.*, **26** [177] 225–29 (1942).—The reported occurrences of natural and artificial merwinite ($3CaO \cdot MgO \cdot 2SiO_2$) are summarized. Merwinite occurred in 7 out of 32 blast-furnace slags suitable for road stones. The optical properties of these and of natural merwinite from Crestmore, Calif., and Scawt Hill, County Antrim, Ireland, agreed well with synthetic merwinite prepared from pure materials in the correct proportions at 1450° to 1500°C. (close to α 1.706, β 1.712, γ 1.724, $2V$ 70° positive, complex twinning). The possibility exists that J. B. Ferguson and H. E. Merwin, who were not aware of merwinite in 1919, confused it with β-$2CaO \cdot SiO_2$. The spacings from X-ray powder photographs (which are given) easily distinguish them. "Falling" blast-furnace slags can be stabilized by the addition of dolomite in place of calcareous flux, as merwinite does not appear to undergo transformation on cooling. **Appendix.** R. W. NURSE.

Ibid., p. 230.—Synthetic merwinite melts at 1590°C. into a melt and a phase resembling $2CaO \cdot SiO_2$ in properties except that the refractive indices are lower (α 1.708, γ 1.735) and the axial angle is very small, being nearly uniaxial. N. concludes that merwinite occurs in the system $CaO–MgO–SiO_2$ as an incongruently melting compound. L.R.B.

Mica in western Australia. ANON. *Chem. Eng. & Mining Rev.*, **35** [410] 38–42 (1942).—Mica is fairly widely distributed throughout Australia, and that of commercially marketable size is always found in dykes of pegmatite in which quartz and feldspar constituents occur in huge masses, while the mica occurs in large crystals or "books" varying in weight from 1 to 100 lb. Mining, cutting, grading, and dressing methods are described. B.C.R.

Minerals of the Varuträsk pegmatite: XVIII, New amblygonite crystals from Varuträsk. STAFFAN TENGNÉR. *Geol. Fören. Förh.*, **62,** 332–34 (1940) (in English); *Chem. Abs.*, **35,** 2820 (1941).—Crystallographic data are given on 2 new specimens, 8 × 10 cm. and 6 × 8 cm. Preliminary X-ray data disagree in part with the values determined by Richmond on Hebron amblygonite. **XIX, Uraninite minerals (ulrichite and pitchblende).** PERCY QUENSEL. *Geol. Fören. Förh.*, **62,** 391–96 (1940) (in English).—A bright canary-yellow mineral has been found in small quantities in the Li pegmatite of Varuträsk. Q. distinguishes 2 distinct varieties, (1) ulrichite and (2) pitchblende. The ulrichite, with UO_2 dominating, occurs in distinct cubic crystals, steely black in color, semimetallic luster, conchoidal fracture, dark-gray streak, and opaque in thin sections. The cubes, with maximum size 7 mm., are often surrounded with yellow alteration products. The pitchblendes, with UO_3 dominating, occur as noncrystalline, grayish black, irregular masses. The yellow alteration products often traverse the parent mineral in all directions. The analysis of ulrichite gives PbO 16.64, U_3O_8 74.4, ThO_2 1.12, $(Ce,Y)_2O_3$ 0.12, Fe_2O_3 0.03, CaO 0.16, MgO 0.03, SiO_2 0.16, insoluble (nonvolatile) 0.32, insoluble (volatile, probably Sb and As) 6.1, sum 99.08%. The PbO content is exceptionally high. The isotopic proportions of Pb in ulrichite were found to be Pb 206 81.94%, Pb 207 15.26%, Pb 208 2.80%. A new analysis of ulrichite on fresh and carefully prepared material gave PbO 18.3, U_3O_8 73.4, ThO_2 3.9, $(Ce,Y)_2O_3$ 0.2, and insoluble 0.2%. This PbO content is the highest found in any analysis of fresh uraninite. The age relations are discussed briefly. For Parts **XVI** and **XVII** see *Ceram. Abs.*, **21** [11] 245 (1942).

Mining in Manitoba in 1942. J. P. DE WET. *Can. Mining Jour.*, **64** [2] 74–80 (1943).—Among the industrial minerals, the discovery of a very large low-grade chromite body in the Bird River area is probably one of the most important finds of the year. Gypsum, limestone and lime, cement, and salt were produced. A Winnipeg company produced ground and activated bentonite for use in oil refineries and foundries. See "Manitoba . . .," *Ceram. Abs.*, **22** [3] 58 (1943). G.M.H.

Mining in Quebec during 1942. JOHN B. DEMILLE. *Can. Mining Jour.*, **64** [2] 84–88 (1943).—The copper and zinc output was increased. Old chromite properties were re-examined, and there will be some production in 1943. Three plants are recovering tungsten concentrates, and there is a small-scale mica production. Kaolin and silica sand are being produced at St. Remi. There is also some production of fluorspar, graphite, sulfur, and tellurium. The province has a huge asbestos production. Outputs of talc, soapstone, and feldspar increased. G.M.H.

Miscellaneous metals and minerals production. RICHARD J. LUND. *Mining Congr. Jour.*, **28** [12] 34 (1942).—The domestic production of quicksilver virtually equals the requirements, but known reserves are low. Lithium ores will be a little short until a large project being constructed at Kings Mountain, N. C., comes into production. The supply of corundum is inadequate; it has been mined in Georgia and Ontario, but recently all supplies have come from South Africa. It was possible to increase production in South Africa, and it may be possible to get some production from Ontario. Deposits at Corundum Hill, N. C., are being investigated, but they are not too promising. It would be desirable to find a domestic source of quartz crystal. Arkansas, North Carolina, and New York have supplied well-shaped crystals in the past, and these and other promising districts are being investigated. W.D.F.

Nature of Georgia kaolin: I, Evidence of chemical and colloidal analysis. LANE MITCHELL AND E. C. HENRY. *Jour. Amer. Ceram. Soc.*, **26** [4] 105–13 (1943).—8 references, 10 figures. **II, Evidence of mineralogical analysis.** *Ibid.*, pp. 113–19.—5 references, 3 figures.

Nonmetallic industrial minerals. OLIVER BOWLES. *Mining & Met.*, **24** [434] 85–91 (1943).—Developments in the production of nonmetallic minerals and substitutes for those now unavailable are reviewed briefly. B.C.R.

Nova Scotia mineral industry during 1942. L. D. CURRIE. *Can. Mining Jour.*, **64** [2] 89 (1943).—Most of the Canadian gypsum production came from this province. Much limestone, dolomite, silica, and granite were produced. The output of barite from Pembroke increased greatly. A trial shipment of fluorspar was made from a discovery near Lake Ainslie. G.M.H.

Olivine. GEORGE W. PAWEL. *Mining & Met.*, **23** [426] 331–35 (1942).—The use of olivine as a raw material in the production of magnesium salts indicates the possibility of also using it for making magnesium oxide, which can be subsequently reduced or chlorinated to anhydrous magnesium chloride and then electrolyzed to produce metallic magnesium. Both deposits of olivine in the U. S., in North Carolina and Washington, are adjacent to cheap power. B.C.R.

Olivine for market. ANON. *Eng. Mining Jour.*, **143** [11] 55 (1942).—Olivine from a mine near Green Mountain in western North Carolina is crushed by the United Feldspar & Minerals Corp. near Spruce Pine. Most of the tonnage is crushed to 8-mesh, and it is usually shipped to Pennsylvania or West Virginia. W.D.F.

Potash oligoclase in Hawaiian lavas. GORDON A. MACDONALD. *Amer. Mineralogist*, **27,** 793–800 (1942).—Interstitial feldspar in Hawaiian lavas with the refractive indices of oligoclase or andesine has an abnormally small positive optical angle. The abnormalities have previously been attributed to an isomorphous mixture of nepheline or carnegieite, but this is made doubtful by the discovery of the material in rocks with normative quartz. It is concluded that the abnormal properties are caused by an admixture of potash feldspar; the compound is unstable at ordinary temperatures but is prevented from mixing by the rapid cooling of the enclosing rocks. W.D.F.

Rapid method of determining soil moisture. J. S. PAPADAKIS. *Soil Science*, **51** [4] 279–81 (1941).—The method consists of weighing a 50-gm. field sample of soil into a volumetric flask and weighing again after the addition of sufficient water to make the volume up to 100 ml. The difference between this weight and that of the flask filled with water alone, multiplied by a factor derived from previous measurements on the type of soil under consideration, gives the oven-dry weight of the soil, from which the soil moisture in the original sample may be calculated. The actual and calculated values for oven-dry weight of 46 samples are presented; agreement in all cases was within 1% and in most cases within 0.1%. V.D.F.

Rehydration study of clays. LOUIS H. BERKELHAMER. *Jour. Amer. Ceram. Soc.*, **26** [4] 120–26 (1943).—12 references, 4 figures.

Relationship of the clay minerals halloysite and endellite. L. T. ALEXANDER, G. T. FAUST, S. B. HENDRICKS, H. INSLEY, AND H. F. MCMURDIE. *Amer. Mineralogist*, **28,** 1–18 (1943).—A study was made of the clay mineral halloysite, $Al_2Si_2O_5(OH)_4$, and the more highly hydrated related mineral, $Al_2Si_2O_5(OH)_4 \cdot 2H_2O$, for which the name endellite is proposed. By means of chemical, electron-microscopic, X-ray diffraction, and petrographic methods it was found that (1) halloysite is formed by the partial dehydration of endellite; (2) halloysite has the same type of aluminum silicate layers as kaolinite, but the layers are usually superimposed in a less orderly manner in the

former than in the latter; (3) endellite has a structure in which kaolinite-type layers alternate with single layers of water molecules; and (4) endellite may be formed by alteration of the constituents of a basic igneous rock or its metamorphic equivalent. W.D.F.

Soil studies in relation to geology in an area in northeast Scotland: I, Mineralogy of the soil parent materials. R. HART. *Jour. Agr. Sci.*, **31** [4] 438–47 (1941).—An account is given of the distribution of four separate boulder clays which form the parent minerals of the soils of Kincardineshire. The mineral compositions of the fine-sand fractions of the boulder clays are given. The boulder clays, notwithstanding color similarities, have been shown by mineralogical examinations to be distinct. The middle boulder clay, largely influenced by rocks of Old Red Sandstone age, has a higher proportion of ferromagnesian silicate minerals than soils from glacial drifts similarly derived elsewhere in Scotland. **II, Soils and their development.** *Ibid.*, **32** [4] 373–88 (1942).—There are many areas in Britain where soil parent materials cannot be differentiated on the basis of solid geology alone, and difficulties are frequently experienced in classifying and mapping the soils. The object of this investigation was to study the parent materials and soils in a complex area of this kind. The area selected was in northeast Scotland, where about half the soil was covered by acid igneous and metamorphic rocks and the rest by sedimentary rocks of Old Red Sandstone age. The geology was complicated by three glaciations, giving rise to diversity of soil parent materials. Five main groups of parent materials were recognized, based on origin, texture, and mineralogical composition: (1) drift derived from acid igneous rocks and schists, (2) boulder clay from similar material plus admixture of sedimentary rocks, (3) fluvioglacial deposits of varied textures, (4) conglomerate or thin drift of and from Old Red Sandstone rocks, and (5) boulder clay derived from Old Red Sandstone rocks where the influence of marls and shales in the drift is strong. These soils are compared and discussed with reference to differences in podzolization, peat development, acidity or basicity, base-exchange status, and the translocation of the sesquioxides present in the clay fractions of the soils. The influence of the parent materials from which the soils were derived on the above characteristics of the soils is discussed. P.S.D.

Study of fire clays in Szechuan Province. FU-HSIANG KO, TSUNG-SHOU HSU, AND TING-CHUAN HSU. *Jour. Chinese Inst. Engrs.*, **13** [4] 49 (1940).—The deposits, the characteristics of the fire clays, and the properties of the grog bodies are discussed. The important fire-clay deposits are (1) Tsiang-tsin (T clay), (2) Shu-yung (S clay), (3) Wei-yuan (W clay), and (4) Nan-chuan (N clay). The empirical formulas calculated from the chemical analyses are as follows:

$$\text{T clay}\left\{\begin{matrix}0.0231\ CaO\\0.0505\ MgO\\0.1051\ MnO\\0.1362\ FeO\end{matrix}\right\}1.00\ Al_2O_3\quad 2.28\ SiO_2\quad 2.39\ H_2O$$

$$\text{S clay}\left\{\begin{matrix}0.0191\ CaO\\0.0094\ MgO\\0.0198\ FeO\end{matrix}\right\}1.00\ Al_2O_3\quad 1.91\ SiO_2\quad 2.01\ H_2O$$

$$\text{W clay}\left\{\begin{matrix}0.0316\ CaO\\0.0073\ MgO\\0.0850\ FeO\end{matrix}\right\}1.00\ Al_2O_3\quad 1.99\ SiO_2\quad 2.00\ H_2O$$

$$\text{N clay}\left\{\begin{matrix}0.0496\ CaO\\0.0304\ MgO\\0.0970\ FeO\end{matrix}\right\}1.00\ Al_2O_3\quad 1.89\ SiO_2\quad 2.03\ H_2O$$

It is clear from the above formulas that all the fire clays are of the kaolin type.

Dry properties of the clays are as follows:

	Clay sample			
	T	S	W	N
Raw color	Black	White	Yellowish white	Black
Specific gravity	1.88	2.01	1.95	1.90
Water of plasticity (%)	29.37	42.39	36.84	34.50
Shrinkage water (%)	8.43	6.32	7.85	7.90
Pore water (%)	20.94	36.07	28.99	26.60
Volume shrinkage (%)	11.49	8.12	11.34	11.40
Linear shrinkage (%)	3.88	2.74	3.77	3.82
Compressive strength (kgm./cm.²)	3.45	2.45		

Fired properties of the clays are as follows:

	Clay sample			
	T	S	W	N
Fired color	Gray	White	Pale yellow	Grayish white
Specific gravity	2.67	2.76	2.74	2.67
Volume shrinkage (%)	28.22	44.11	32.26	31.10
Linear shrinkage (%)	9.61	14.74	10.77	10.41
Apparent porosity (%)	20.27	25.16	22.93	23.07
Water absorption (%)	11.24	13.28	12.64	11.21
Bulk specific gravity	1.85	1.93	1.88	1.85
Apparent specific gravity	2.34	2.57	2.44	2.48
Tensile strength (kgm./cm.²)	48.40			
Compressive strength (kgm./cm.²)	255			

The results of tests on the grog bodies are briefly summarized as follows: For T and N clays, bodies containing 50 to 90% of grog are sound and do not crack. For S clay, all grog bodies containing 0.0 to 90% of grog crack and are unsound. For W clay, bodies containing 60 to 90% of grog are sound and do not crack. All the fire clays are poor in workability. T and N clays are more plastic than the others, and S clay is the poorest. It is preferable that some plastic clay should be added to increase its plasticity and fired strength. The best firebrick body should have a composition of 50 to 60% grog with 40 to 50% of raw clay. M.C.L.

Talc from North Georgia. A. H. HUBBELL. *Eng. Mining Jour.*, **143** [11] 45–49 (1942).—The talc is found in Murray County, where peridotite intrusions occurred in the Ocoee formation of Cambrian age. This formation now consists of quartzite and quartz schist, and the peridotite has altered to talc. The deposit is 2 to 30 ft. thick and extends up to 193 ft. on the dip. Numerous small, shallow openings, which are simply equipped, have been made by three companies. The mining procedure is to follow the talc with attention focused on saw talc for crayons; these are used by metal workers. Other talc is ground and used as a filler in rubber, paper, paint, and cloth; as foundry facings; and in insecticides, asphalt roofing and shingles, lacquers, and lower-grade cosmetics. W.D.F.

Talc, pyrophyllite, and soapstone. ALLAN F. MATTHEWS. *Mineral Ind.*, **50**, 529–36 (1941).—High-grade talc is critically needed in the production of steatite insulators for high-frequency radios. Steatite is also used in making ferrules utilized in steel welding as a protection

for wooden parts. Prices, production, and sources are given. B.C.R.

U. S. turns to South America for strategic materials. CHARLES WILL WRIGHT. *Mining & Met.*, **23** [432] 590–92 (1942).—Mica, heretofore imported from India, may be obtained from Brazil, Argentina, Peru, and Venezuela; Brazil is the chief source, where it occurs as a ruby-colored muscovite in sizes up to a few feet in diameter. It is inferior to Indian mica. Argentine mica is inferior to that obtained in Brazil. See "Brazil's . . .," *Ceram. Abs.*, **22** [2] 37 (1943). B.C.R.

SEPARATE PUBLICATIONS

Barite, Witherite, and Barium Chemicals. BERTRAND L. JOHNSON AND K. G. WARNER. U.S. Bur. Mines Minerals Yearbook, 1941, preprint. Supt. of Documents, Washington, D. C. 12 pp. Price 5¢. R.A.H.

Chromite Deposits of Red Bluff Bay and Vicinity, Baranof Island, Southeastern Alaska. P. W. GUILD AND J. R. BALSLEY, JR. *U. S. Geol. Survey Bull.*, No. 936-G, 16 pp. (1942). Supt. of Documents, Washington, D. C. Price 20¢.—Small deposits of chromite occur in serpentinized ultramafic intrusive masses on Baranof Island, southeastern Alaska. The body of greatest importance as a possible source of chromite is at Red Bluff Bay on the east coast of the island. The ultramafic rocks are dunite and pyroxenite, largely altered to serpentine or talc. The ore deposits are lenticular concentrations of chromite, a normal accessory mineral of dunite. In general, the ore has a low ratio of chrome to iron. See *Ceram. Abs.*, **21** [7] 153 (1942). R.A.H.

Graphical Correlation of Recovery and Product Composition in Separation Processes. FOSTER FRAAS. *U. S. Bur. Mines Repts. Investigations*, No. 3663, 4 pp. (1942). Free.—F. discusses separation processes in which composition of concentrate decreases as recovery of component increases. R.A.H.

High-Grade Dolomite Deposits in the United States. JOHN H. WEITZ. *U. S. Bur. Mines Information Circ.*, No. 7226, 86 pp. (1942). Free.—W. gives data on locations, extent, accessibility, workability, and chemical composition of high-grade dolomite deposits throughout the U. S. R.A.H.

Mineral Dressing of Oregon Beach Sands: I, Concentration of Chromite, Zircon, Garnet, and Ilmenite. JOHN DASHER, FOSTER FRAAS, AND ALTON GABRIEL. *U.S. Bur. Mines Repts. Investigations*, No. 3668, 19 pp. (1943). Free.—Deposits and separations desired are described, and the results are given of experiments on hydraulic tabling, electrostatic separation, cleaning of surfaces, magnetic separation of electrostatic black-sand concentrates and table concentrates, composite results, and the separation of zircon and garnet. R.A.H.

Tin-Spodumene Belt of the Carolinas (preliminary report). T. L. KESLER. *U. S. Geol. Survey Bull.*, No. 936-J, 24 pp. (1942). Supt. of Documents, Washington, D. C. Price 50¢.—Cassiterite and spodumene occur in hundreds of pegmatite bodies between Lincolnton and Grover, N. C. Many of the pegmatite bodies contain 15% or more of spodumene, and unusually rich parts of bodies average 30 to 50%. It is estimated that two favorable areas contain a reserve of at least 650,000 tons of spodumene. R.A.H.

PATENTS

Concentrating nonmetalliferous ores. A. W. RALSTON AND E. W. SEGEBRECHT (Armour and Co.). U. S. 2,313,360, March 9, 1943 (May 24, 1940).

Extracting beryllium compounds from silicate minerals. H. C. KAWECKI (Reconstruction Finance Corp.). U. S. 2,312,297, Feb. 23, 1943 (April 8, 1941).

Preparation of clays. SOUTH METROPOLITAN GAS CO. AND J. T. VERYARD. Brit. 550,402, Jan. 20, 1943 (July 9, 1941).

Recovering manganese from ore. ELFEGO RIVEROLL. U. S. 2,310,258, Feb. 9, 1943 (Aug. 11, 1941).

Substitutes for natural feldspathic rocks. DOULTON & CO., LTD., AND J. ALLEN. Brit. 550,741, Feb. 3, 1943 (Nov. 12, 1941).

Working of mineral or mineral-like bodies. LINDE AIR PRODUCTS CO. Brit. 550,683, Feb. 3, 1943 (April 18, 1939).

Chemistry and Physics

Analysis for potassium by its natural radioactivity. R. BOWLING BARNES AND D. J. SALLEY. *Ind. Eng. Chem., Anal. Ed.*, **15** [1] 4–7 (1943).—The authors describe equipment for a rapid and comparatively simple determination of potassium by taking advantage of its natural radioactivity. Illustrated. F.G.H.

Analytical patterns in the study of mineral and biological materials. HERMAN YAGODA. *Ind. Eng. Chem., Anal. Ed.*, **15** [2] 135–41 (1943).—Illustrated. F.G.H.

Calculating chemist. ANON. *Ind. Bull. of A. D. Little, Inc.*, No. 186, p. 1 (Feb., 1943).—Through elaborate computations it has been shown that the new quantum mechanics, which so successfully elucidated the structure of the atom, can be applied to molecules, i.e., to chemistry. It has been possible to make these computations only for hydrogen, the simplest of all chemicals, but with adequate computational facilities they can also be made for the more complex chemicals. The theory of quantum mechanics is entirely sufficient to explain all chemical phenomena, such as reaction rates and properties, without any appeal to experiment. Rock bottom in the fundamentals of chemistry has been reached, and it is now believed possible to build up an explanation of chemical phenomena from the basic properties of the elementary particles. Only computational problems lie between principle and practice. H.E.S.

Colloid chemistry in ceramics. A. L. JOHNSON. *Jour. Amer. Ceram. Soc.*, **26** [3] 88–92 (1943).—8 references, 3 figures.

Colorimetric determination of cobalt with terpyridyl. M. L. MOSS WITH M. G. MELLON. *Ind. Eng. Chem., Anal. Ed.*, **15** [1] 74–75 (1943).—A new colorimetric method for the determination of cobalt is described. Variations in pH between 2 and 10 do not affect the colored complex, and Beer's law is valid for cobalt concentrations of 0.5 to 50 p.p.m. This is the optimum range for determinations with a 1-cm. transmission cell. Interference by most of the common metals, except copper, nickel, and iron, is not serious. Cyanide and dichromate should be absent. Because of the limited stability of the color, fresh standards for visual work should be prepared daily. Illustrated. F.G.H.

Colorimetric determination of copper with 1,10-phenanthroline. M. L. MOSS WITH M. G. MELLON. *Ind. Eng. Chem., Anal. Ed.*, **15** [2] 116–18 (1943).—The intense brown color of cuprous-phenanthroline complex may be used as the basis of a colorimetric method for the determination of copper. Beer's law is valid for concentrations of 0.5 to 10 p.p.m. of copper at least, this being the range most suitable for measurements with a 1-cm. transmission cell. The colored system is stable for at least 24 hr. Of the metals whose compounds are soluble under the conditions used, only cadmium, cobalt, nickel, and zinc interfere seriously. Metals which precipitate with ammonia are removed during the course of the procedure. Among the anions studied, only cyanide, dichromate, and thiosulfate interfere appreciably. Illustrated. F.G.H.

Colorimetric determination of traces of cobalt. IAN ARMSTRONG BLACK. *Soil Science*, **51** [5] 387–90 (1941).—The α-nitrosol-β-naphthol color reaction was employed, the yellow color of the reagent being eliminated by treatment after the reaction with $NaHSO_3$, which does not affect the brown color of the cobalt compound. Iron, which interferes in the reaction, was removed by precipitation as basic acetate. Maximum color development occurred at pH 5.2, but it was not critical between 5.0 and

5.3; ammonium acetate was used as a buffer to facilitate this adjustment. The Hellige colorimeter was used with this scheme on ten standard samples ranging from 2.0 to 7.4 γ. Agreement in all cases was within 10%, and it was better with larger amounts of Co. V.D.F.

Determination of alkalis in glass. Denatured alcohols as substitutes for U.S.P. grain alcohol. P. A. Webster and R. M. Crane. *Ind. Eng. Chem., Anal. Ed.*, **15** [1] 36 (1943).—The procedures for determining sodium and potassium in soda-lime glasses specify the use of 95% ethyl alcohol in the preparation of wash solutions. In the method for sodium, the precipitate of sodium zinc uranyl acetate is washed with a saturated solution of the triple acetate salt in 95% ethyl alcohol. In the potassium procedure, the potassium chloroplatinate precipitate is washed with 80% ethyl alcohol. The possibility of substituting one of the specially denatured alcohols for 95% grain alcohol in the determination of sodium and potassium was investigated. Two commercial denatured alcohols were selected for trial, one containing about 10% of ethyl ether and the other about 10% of acetone. These two products were compared with 95% ethyl alcohol in a series of determinations of sodium and potassium in the National Bureau of Standards sample of soda-lime glass No. 128. The tests indicate that the two denatured alcohols selected are satisfactory as substitutes for 95% grain alcohol. F.G.H.

Effect of small concentrations of hexametaphosphate on iron oxide surfaces. Fred Hazel. *Jour. Phys. Chem.*, **46**, 516 (1942).—Hexametaphosphate not only inhibits the precipitation of calcium carbonate from alkaline solutions but also retards the corrosion of iron at pH values below the neutral point. The properties of alkalis and of hexametaphosphate to inhibit corrosion may be attributed to the property of these substances of converting the surface of iron oxide from an electropositive to an electronegative condition, thus rendering the surface of the metal more noble. Coagulation data for ferric oxide sols were obtained for ortho-, pyro-, and hexa-metaphosphate, with and without added calcium chloride. R.A.G.

General theory of the isoelectric point: I. T. L. Hill. *Jour. Phys. Chem.*, **46**, 417 (1942).—A general expression is given for the isoelectric point of an aqueous solution. Solubility, ionization, migration, conductivity, and change of isoelectric point with temperature are discussed mathematically. **II.** *Ibid.*, p. 597.—The modifications introduced in the isoelectric point by using activity coefficients and thermodynamic equilibrium constants in place of the concentration equilibrium constants used in Part I are discussed. Brief mention is made of colligative properties and ionic strength. R.A.G.

Heat transfer and thermal resistance: I. N. J. Hassid. *Jour. Soc. Chem. Ind.* [London], **61** [4] 63–65 (1942).—The advantages of the use of units of thermal resistivity in place of thermal conductivity are argued. A table of resistivities is appended. L.R.B.

Internal electroanalysis. C. L. Luke. *Bell. Lab. Record*, **19** [9] 294 (1941).—The improvement of apparatus for electroanalytical methods applicable to the separation and quantitative determination of very small amounts of impurities in alloys and other materials is discussed briefly. P.S.D.

Method for the determination of carbonate in small amounts of materials. F. E. Jones. *Jour. Soc. Chem. Ind.* [London], **59** [1] 21–23 (1940).—A method based on the $Ba(OH)_2$ vacuum method of Ampt and Cornell for the determination of CO_2 has been developed for 50 mgm. of material. It is suitable for building materials which do not evolve any gas other than H_2 and CO_2 with acid. The CO_2 evolved with acid is absorbed in standard $Ba(OH)_2$ *in vacuo* in a simple glass apparatus. The excess $Ba(OH)_2$ is titrated with standard HCl. The method is accurate and may be considered as an alternative to the gas-volume method (*Ceram. Abs.*, **21** [6] 132 (1942)). L.R.B.

Method for determining phosphate in soil extracts. Ian Armstrong Black. *Soil Science*, **51** [4] 289–98 (1941).—Soils were encountered with which the method of Warren and Pugh gave erratic results, apparently because of variable pH and incomplete removal of iron. By substituting potassium permanganate for the usual sodium permanganate, B. obtained consistent results. Details of a rapid method of analysis are given, together with a more lengthy procedure developed to confirm the results. The effects of acidity and the presence of iron, titanium, vanadium, aluminum, silica, and organic matter are discussed, and methods of avoiding their interference are detailed. V.D.F.

Microvol, apparatus for measuring small volumes of gas. R. T. Sanderson. *Ind. Eng. Chem., Anal. Ed.*, **15** [1] 76 (1943).—The microvol is a simple and useful device for measuring very small volumes of condensable gas in a vacuum apparatus. Volumes of about 0.05 cu. mm. can be measured within 10%, the accuracy improving rapidly with increase in sample size. A single device can readily be constructed to measure a complete range of volumes from 0.01 cu. mm. up to several milliliters. The microvol has the following definite advantages over a McLeod gauge used for the same purpose: (1) The entire gas sample, rather than only a part, is directly measured, so that the microvol is more sensitive. (2) The pressure-volume products can be checked very simply by readings at widely different and quickly adjusted mercury levels. (3) A much greater range of volumes can be measured in the same apparatus. Illustrated. F.G.H.

New method for determination of total phosphoric acid in soils. J. G. Shrikhande. *Jour. Agr. Sci.*, **32** [4] 406–12 (1942).—McLean's shorter method of H_2SO_4-HNO_3 digestion of soil for total P_2O_5 failed to give satisfactory results on certain red soils from Ceylon, although Hall's HCl method was satisfactory. The cause of failure of McLean's method was interference from the larger quantities of the various bases extracted by the H_2SO_4-HNO_3 digestion. A H_2SO_4-Se method served as a good substitute for the H_2SO_4-HNO_3 method in soil digestions and gave results substantially the same as those for the Hall method and for a modified McLean method which was also investigated. Moreover, there are certain advantages of the H_2SO_4-Se method, such as the possibility of determining both nitrogen and phosphorus on the same digest. Details of the new standardized method are appended. P.S.D.

New reagents for sodium. Earle R. Caley and Lockhart B. Rogers. *Ind. Eng. Chem., Anal. Ed.*, **15** [1] 32–36 (1943).—The authors discuss the value of a reagent containing uranyl acetate and cupric acetate for the detection and determination of sodium in the presence of lithium. F.G.H.

Occurrence of selenium in Utah forage plants. Wendell L. Holt and J. E. Greaves. *Soil Science*, **51** [4] 299–306 (1941).—A colorimetric procedure using codeine for the analysis of selenium in amounts between 0.4 and 2.5 p.p.m. is described. For larger amounts, a modification of the volumetric method of Robinson, Dudley, Williams, and Byers was developed. V.D.F.

Particle-size studies. Properties of finely divided materials. H. E. Schweyer. *Chem. Rev.*, **31**, 295–317 (1942).—A survey of the literature on particle-size studies indicated the desirability of classifying particle properties according to their influence on other properties. Such a classification was made, and experimental data are discussed on the basis of this classification. A study was made of five closely fractionated materials having different particle shapes about 50 μ in size. The two mean microscopic diameters based on the square root of the projected area and the shorter of the two visible dimensions at right angles to each other gave results essentially the same for silica, coal, slate, and galena, while for mica the latter microscopic diameter gave results equal to 0.9 of the former. The mean microscopic diameter varied from 1.2 to 1.5 times the sieve aperture and from 1.1 to 2 times the equivalent sedimentation diameter, depending upon the material. The mean sedimentation diameter of materials just passing a sieve may be 0.8 to 1.2 times the sieve aperture, but the point of separation of a No. 325 sieve for combining sieving and sedimentation analyses may be

taken as 53 μ for many materials. S. points out that the computation of specific surface from size-distribution data, using shape-constant ratios, rather than from surface and volume constants, would simplify the problem considerably. See *Ceram. Abs.*, **21** [11] 241, 245 (1942). W.D.F.

Photometric routine estimation of traces of lead by dithizone. JOSEPH SCHULTZ AND MELVIN A. GOLDBERG. *Ind. Eng. Chem., Anal. Ed.*, **15** [2] 155–58 (1943).—A simple photometric procedure for the routine determination of lead by dithizone is described. The procedure is fairly rapid, requires very little special equipment, and is sufficiently accurate for most control work (within 1 or 2 μgm.). The method has been used for some time on a number of common materials used in the cosmetic industry. The results have been satisfactory, and the procedure could be readily adapted to virtually any material. Detailed methods for the preparation of samples of materials commonly used in the manufacture of cosmetics have been worked out. These methods could be followed by analysis according to any of the known dithizone procedures. Aluminum and titanium interfere with the extraction of lead by dithizone. F.G.H.

Polarographic determination of manganese as tri-dihydrogen pyrophosphatomanganiate. I. M. KOLTHOFF AND J. I. WATTERS. *Ind. Eng. Chem., Anal. Ed.*, **15** [1] 8–13 (1943).—A procedure is presented by which manganese is quantitatively oxidized with lead dioxide to the trivalent state in a medium which contains a large excess of pyrophosphate at a pH smaller than 4. The concentration of the manganic manganese in the complex is determined polarographically. Evidence shows that the violet complex ion is tri-dihydrogen pyrophosphatomanganiate. Illustrated. F.G.H.

Rapid determination of aluminum in magnesium alloys by means of 8-hydroxyquinoline (oxine). C. H. WOOD. *Jour. Soc. Chem. Ind.* [London], **61** [2] 29–31 (1942).—The phosphate method for aluminum depends on a fusion and reprecipitation. To save time, the oxine method was tried after initial precipitation of the aluminum as hydroxide. The latter was dissolved in acid and precipitated as oxine from a solution suitably buffered with ammonium acetate. The redissolved oxine precipitate was titrated against bromate-bromide solution, and the excess bromine was titrated back with thiosulfate. The method is suitable for magnesium alloys. Much iron must be removed as sulfide. The method gives results reproducible to less than 2%. L.R.B.

Separation of iron from cobalt or nickel. R. J. DEGRAY AND E. P. RITTERSHAUSEN. *Ind. Eng. Chem., Anal. Ed.*, **15** [1] 26–27 (1943).—By the addition of oxalic acid before precipitation of ferric hydroxide by ammonium hydroxide, coprecipitation of cobalt and/or nickel is prevented, and a quantitative separation of these metals can be obtained. The oxalic acid does not interfere with the subsequent colorimetric determination of either the cobalt or the iron or with the quantitative determination of nickel. See "Colorimetric . . .," *Ceram. Abs.*, **22** [3] 59 (1943). F.G.H.

Soluble silicates in ceramics. L. A. RICHARDSON. *Jour. Can. Ceram. Soc.*, **11**, 41–44 (1942).—R. discusses the use of soluble silicates in ceramics under the following topics: (1) commercial sodium silicate, (2) colloidal silicates, (3) crystalline silicates, (4) general uses, (5) ceramics and related applications, (6) adhesives, (7) cements, (8) binder, (9) coatings and paint, (10) deflocculant and flocculant, (11) detergent, (12) inhibitor, and (13) flux and raw materials. G.A.K.

Stability properties of hydrophobic colloidal solutions. S. LEVINE AND G. P. DUBE. *Jour. Phys. Chem.*, **46**, 239 (1942).—The energy maximum in the authors' expression for the interaction of two particles determines the stability of a sol fairly satisfactorily for the region of very slow coagulation and roughly in the coagulation zone. The dependence of this energy maximum on particle charge, electrokinetic potential, electrolyte concentration, valence of the ion, and particle radius are examined. The phenomenon of charge reversal by trivalent ions is also studied. R.A.G.

Thermal expansion of titanium. PETER HIDNERT. *Jour. Research Nat. Bur. Standards*, **30** [2] 101–105 (1943); RP 1520. Price 5¢.—The coefficient of expansion of titanium increases from about 5×10^{-6} per °C. at −150°C. to about 12×10^{-6} per °C. at 650°C. R.A.H.

Viscosity determination of glass-furnace slags. R. HAY. *Jour. West Scot. Iron & Steel Inst.*, **49** [6] 89–99 (1942).—Inasmuch as the rotating cylinder type of apparatus had a lower limit of 10 poises, a logarithmic decrement method applicable to an oscillating cylinder instead of a disk was used for all viscosity measurements. The liquid to be examined is contained between two concentric cylinders, the outer one being stationary and the inner one fixed rigidly to the lower end of a torsion pendulum. The damping effect of the liquid on the motion of the pendulum is measured by the ratio of the amplitude of two consecutive swings and thus is the measure of the viscosity of the liquid. Synthetic slag compositions were used. In the ternary system CaO–Al_2O_3–SiO_2, viscosity increases rapidly with increasing free silica, even at temperatures around 1600°C. Melts with a high percentage of anorthite, gehlenite, or free silica show a rapid decrease in viscosity with increasing temperatures, all being quite fluid around 1700°C. Viscosities for various compositions are given for temperatures of 1450°, 1500°, 1550°, and 1600°C. The effect of MgO on certain CaO-Al_2O_3-SiO_2 compositions at these temperatures is shown. B.C.R.

SEPARATE PUBLICATION

Contact Potential in Electrostatic Separation. FOSTER FRAAS AND OLIVER C. RALSTON. *U. S. Bur. Mines Repts. Investigations*, No. 3667, 17 pp. (1942). Free.—An apparatus that separates particles of minerals electrostatically after charging by intimate contact on horizontal vibrating plates is described. R.A.H.

PATENTS

Chrome yellow. H. E. BRUCE. U. S. 2,313,619, March 9, 1943 (Dec. 23, 1941).—The step in the process of producing a pigment having a yellow color which consists in reacting a metal sulfamate with a chromium compound, the metal being taken from the group bismuth, antimony, tin, cadmium, lead, and zinc and the chromium compound being taken from the group chromic acid, potassium dichromate, and sodium dichromate.

Crystalline magnesium hydroxide. H. H. CHESNY. Can. 409,564, Dec. 29, 1942 (Sept. 17, 1937). G.M.H.

Making titanium dioxide pigments. BRITISH TITAN PRODUCTS CO., LTD. Brit. 550,995, Feb. 17, 1943 (Aug. 2, 1940).

Preparation of hydrated titanium oxide sol. PETER TILLMANN, FRIEDRICH RASPE, AND JOSEPH HEINEN. Can. 409,550, Dec. 22, 1942 (Oct. 20, 1938). G.M.H.

Preparation of titanium dioxide sol. PETER TILLMANN AND FRIEDRICH RASPE. Can. 409,549, Dec. 22, 1942 (April 25, 1938). G.M.H.

Production of zirconia. M. O. AXT AND F. W. BERK AND CO., LTD. Brit. 550,288, Jan. 13, 1943 (Sept. 12, 1941).

Titanium-compound production. D. W. YOUNG (General Chemical Co.). Can. 410,634, Feb. 16, 1943 (March 4, 1941; in U. S. March 29, 1940). G.M.H.

Titanium dioxide manufacture. M. J. BROOKS (General Chemical Co.). Can. 410,633, Feb. 16, 1943 (March 4, 1941; in U. S. March 29, 1940). G.M.H.

Titanium oxide preparation. H. F. MERRIAM AND M. J. BROOKS (General Chemical Co.). Can. 410,236 and 410,237, Jan. 26, 1943 (April 8, 1940; in U. S. April 20, 1939). G.M.H.

General

American synthetic sand practice. NORMAN J. DUNBECK. *Trans. Amer. Foundrymen's Assn.*, **49** [1] 141–64 (1941).—D. discusses (1) the base sand used and the properties that it should possess and (2) the various types of clay bonds, viz., kaolinite, illite, and montmorillonite. A table shows the relative values of these three types of clays under twelve classifications. D. also discusses the value of combinations of clays which confer specially desired properties on sands, particularly in the matter of hot strength. The best clays or combinations to be used in synthetic sands for light, medium, and heavy nonferrous, gray-iron, malleable iron, and steel castings are outlined, and the methods of application of clays, particularly the proper methods of adding various types of clays in sand heaps, system sands, and facing sands, are discussed. The disadvantages of both naturally bonded and synthetic sands and the advantages of the latter are given. H.E.S.

Ceramic lines widen rapidly in war effort. G. C. KEITH. *Clay Prod. News*, **16** [1] 3 (1943).—K. describes the various wartime uses for ceramic materials in Canada. Precision optical instruments, sheet window glass, photographic plates, and ampoules for drugs have been produced in Canada since 1939. In the refractory field, calcined magnesia and chromite are being produced in the Province of Quebec. Extensive studies on steatite bodies have been made, and a steatite industry has been established. Other industries mentioned include the tableware, sanitary-ware, abrasives, heavy clay products, and insulating materials industries. G.A.K.

Chemical treatment of water for steam raising. BURROWS MOORE. *Ind. Chemist*, **18**, 383–86 (1942).—M. discusses the chemical treatment of water from the aspect of (*a*) the character of the water and (*b*) the various units of the steam-generating plant and the plant where the steam is to be utilized. The units of the generating plant which are directly concerned are (1) boiler drum and tubes, (2) superheater, (3) economizer, (4) condenser, and (5) connections. Various treatments for each problem are considered. H.E.S.

Clay bonding of molding sands. HARRY L. DAASCH. *Trans. Amer. Foundrymen's Assn.*, **48**, 113–40 (1940).—Bentonite-sand mixtures and natural sands were studied, and the results of various conditions of mixing, mulling, and heating are reported. The importance of mulling-water quantity is discussed, and the consideration of an optimum mulling moisture for sand-preparation processes is proposed. Specific cases are cited wherein the heat-of-wetting theory and calculations may be used as a measure of the efficiency of a bond substance. H.E.S.

Coal-handling installation for new plant extension. M. L. WHITING. *Combustion*, **14** [9] 35–38 (1943).—A coal-handling system designed to handle 200 tons per hr. provides the utmost flexibility without sacrificing available coal-storage space. Flight conveyers are employed, and all operations are interlocked. Precautions are taken to avoid any dust nuisance. Illustrated. H.E.S.

Colloidal graphite, a modern lubricant. RALPH K. CARLETON. *Chem. Industries*, **52** [1] 50–52 (1943).—Although the amount of artificial graphite is increasing, the mining of graphite is still an important industry. Artificial graphite is made by volatilizing carbon in electric furnaces at about 4000°C.; upon condensing, it becomes crystalline. When artificial graphite is colloidalized and suspended in liquid carriers, it imparts properties of lubricating, conductive, absorptive, reflective, and pigmentary value to the surfaces of bodies. Graphite films on metals are used primarily for lubricating purposes, and they provide efficient dry lubrication for extended periods of time without oil. A "graphoid" surface is more easily wetted with oil, and graphite increases the critical temperature of the oil and does not induce sludge formation or increase the viscosity of the oil. Cellophane may be covered with decorative graphite films. Colloidal graphite films on glass are used in cathode-ray tubes, ionization chambers, etc. Optical wedges are made from colloidal graphite dispersed in a gelatine solution. Corona loss is reduced on porcelain and Pyrex brand insulators of the suspension type by applying a graphite film to the threaded insulator supports. Graphite produced in the electric furnace and colloidally dispersed in a suitable carrier fluid produces a lubricant which will withstand the high temperatures encountered in many present-day industrial processes. The dispersions best suited for the majority of high-temperature applications are (1) oil dispersion, (2) water dispersion, and (3) mineral spirits dispersion. Graphoid surfaces possess a very low coefficient of expansion. Oil charged with colloidal graphite may be fed through existing lubricators without modification. Colloidal graphite, in contrast with the powdered material, does not accumulate in the bearing and is unaffected by the centrifugal force created in high-speed wheel bearings. 14 references, 4 illustrations. E.D.M.

Combination gas and stoker firing. ANON. *Combustion*, **14** [8] 44 (1943).—An installation for the combination burning of coke breeze and coke-oven gas is described and illustrated. The units consist of three two-drum, bent-tube, steam-generating units, one being fired with gas alone and the other two with gas over traveling-grate stokers. Coke-oven gas, with a heating value of 530 B.t.u. per cu. ft., is the primary fuel. The coke breeze has a heating value of 10,800 B.t.u. per lb., averages about 6% moisture, and normally is of a size to pass through a $^{5}/_{8}$-in. screen. H.E.S.

Cooling and storage of foundry sand. H. L. MCKINNON. *Trans. Amer. Foundrymen's Assn.*, **48**, 87–112 (1940).—Two important problems that confront the production foundry are (1) the cooling and (2) the storage of molding sand. The application of proper equipment, together with correct control, solves the problem. The proper design and installation of storage bins and hoppers are also discussed. H.E.S.

Drying out of synthetic sands. N. J. DUNBECK. *Trans. Amer. Foundrymen's Assn.*, **50** [3] 937–52 (1943).—As the drying-out properties of molding sand are important in foundry molds, D. studied this characteristic in both naturally bonded and synthetic sands. Treating agents designed to lower the vapor pressure of the water were introduced into the sand mixture with the tempering water. Test results include the effects of various treatments of southern- and western-bentonite-bonded sands and fire-clay-bonded sands. Numerous substances which lower the vapor pressure of water were added to the sand mixtures in the manner indicated above. D. records the effect of these agents on the drying-out characteristics of sand mixtures and on the properties of the sand. As fuel oil has been used to reduce the drying-out of molding sand, the effect of this material was also investigated. H.E.S.

Dust hazards in tremolite talc mining, including roentgenological findings in talc workers. W. SIEGEL, ADELAIDE R. SMITH, AND LEONARD GREENBURG. *Amer. Jour. Roentgenol. & Radium Therapy*, **49**, 11–29 (Jan., 1943).—Since 1921 there has been a marked increase in the use of talc in the ceramic industry. Fourteen thousand more tons of talc and related materials were sold in 1937 than in 1936, about 10,000 tons going to the ceramic industry where talc is used chiefly as a constituent of glazed wall tile. About sixty other industrial uses of talc are listed. The U. S. has been producing 65% of the world supply. Industrial hygienists have been inclined to consider silicate dusts (to which talc belongs) as relatively harmless, asbestos alone being excepted. The free-silica content of industrial talc is often 1% or less. Talc has about 65% of SiO_2, the combined form, together with 32% MgO and 5% H_2O. After a study of increasing compensation claims for incapacitating fibrosis in talc workers and the occurrence of five fatal cases in six (all presented in detail), the New York State Divisions of Hygiene and of Tuberculosis undertook a joint investigation of the talc industry and clinical and roentgenological examinations of talc miners. Mining operations and dust concentrations

in three talc mines in St. Lawrence County in northern New York State are given in detail for 1940–1941. Although talc ore is obtained by underground mining, little dust control was found in the three mines studied. St. Lawrence County talc is of the fibrous variety known as asbestine, which is noted for its clear whiteness, and is used as an ingredient in the manufacture of paint and tile. With it is found tremolite, a calcium magnesium silicate in a fibrous or asbestiform state, which eventually changes over into talc. Two hundred twenty-one men from seven plants received an initial roentgenological examination and, ten months later, a second examination. Advanced fibrosis was found in thirty-two men, an incidence of 14.5%. These cases occurred among 107 men who had worked in tremolite talc for ten years or more, giving an incidence of 29.9% for this group. The comprehensive survey thus identified tremolite talc as a silicate dust capable, like asbestos, of causing a disabling pneumoconiosis. Some evidence appeared also of an increased susceptibility to tuberculosis resulting from tremolite talc fibrosis. Exposure to this hitherto unsuspected source of dust invasion therefore constitutes a definite industrial hazard calling for control by suitable engineering methods. 23 references. K.R.

Dust investigations in the ceramic industry: IV, Pan-ground versus disintegrator-ground earthenware white-tile dust. K. L. GOODALL. *Trans. Brit. Ceram. Soc.*, **42** [1] 1–10 (1943).—Because of the considerable silica content of tile dust, there is a silicosis risk for workers engaged in the dust preparation and tile-press-shop processes. In an investigation made to devise further health safeguards for the persons employed in these processes, it became of interest to ascertain whether the dust produced by pan-mill grinding was different from that produced by disintegrator grinding insofar as its size distribution in mass was concerned and also whether the dust clouds resulting from the use of the two kinds of dust in similar processes differed in size distribution. If substantial differences exist, the coarser dust, if inhaled, would be less likely to result in damage to workers' lungs, and recommendations could be made to the industry accordingly as to the method of grinding preferred on health grounds. Direct microscopical determinations of the size distributions of samples of pan- and disintegrator-ground dust obtained from the majority of the firms in the industry and of thermal-precipitator samples of dust clouds arising from pan- and disintegrator-ground dusts and associated with various processes and with general atmospheres met with in the tile-pressing shops were made. These lead to the conclusion that the size distribution of the dusts by either process of grinding is virtually identical and that the size distribution of the dust particles in the air of the tile-pressing shops is not influenced by the method of preparation of the dust. For Parts **I–III** see *Ceram. Abs.*, **18** [5] 140–41 (1939). R.A.H.

Effect of resin binder additions on the properties of molding sands. EMILE PRAGOFF AND C. P. ALBUS. *Trans. Amer. Foundrymen's Assn.*, **50** [2] 337–79 (1942).—The effect of additions of a pulverized high-melting pine resin on the physical properties of two synthetic molding sands is discussed. The resin imparts added dry strength to the sand beyond that normally expected from the clay alone. The sand containing resin, when air-dried, shows a higher mold hardness and reaches this hardness sooner. When fully dried, the resin-bonded sand retains its dry compression strength better when exposed to moist atmosphere. When subjected to heat during pouring, the resin decomposes and generates an appreciable volume of reducing gas. The resin loses bond rapidly, as shown by hot-strength tests, and had little effect on the expansion of the two sands examined. The addition of resin reduced the tendency of a synthetic-bonded sand to crack on shock heating. H.E.S.

Engine wear. ANON. *Lubrication*, **28** [12] 137–44 (1942).—The Texas Co. describes proper methods and lubricants for running-in metal parts. Further wear may be prevented by (1) reduction of frictional heat by the use of a sufficiently oily lubricant, (2) use of an oil with a high evaporating temperature, (3) use of an oil containing antiweld agents, which provide a hard tenacious coating, (4) use of metals of the highest practical thermal conductivity and a design incorporating the shortest possible thermal paths, and (5) use of the lowest cylinder temperature practical, with due regard to the power required for cooling. H.E.S.

Fly-ash erosion in steel-mill boilers. J. H. REID. *Steel*, **111** [8] 68–73 (Aug. 24, 1942).—The erosion factor of several large boilers served by different types of fans is given. R. recommends that coal-burning equipment be designed to eliminate the ash while it is still in a molten state in the furnace. This improvement in the art of burning coal would be the most effective manner of reducing fly-ash erosion. H.E.S.

How to get the most from your wire rope. GILES E. MACQUEEN. *Excavating Engr.*, **36**, 606–608 (1942).—Wire rope has developed into a highly specialized product. Improper handling may ruin it before it is installed. Both preformed and nonpreformed rope should be seized before it is cut to hold the lay of the rope. The rope should be removed from the reel or coil so that no circle or loop will form a kink which injures the rope. After the rope is installed on the machine it should be limbered up by operating the machine under light load until the rope adapts itself to the job. Wire rope is internally lubricated, but on work where the lubricant will not come in contact with the material handled the rope should be periodically coated with lubricant. A larger sheave should be used if possible, and both drums and sheaves should be kept well lubricated. The groove for the rope should be smooth and free of corrugations and of the proper size not to pinch the rope. Preformed rope is best for resisting high bending stresses. The rope should not touch hard substances such as boulders and rails. W.D.F.

Industrial planning: I. WALTER S. LANDIS. *Chem. Industries*, **51** [3] 342–45 (1942).—Industrial planning is necessary to provide work for those demobilized and those in war industries. This may amount to 30,000,000 people. Wages cannot continue to rise without regard to productivity. There will also be the problem of surplus equipment. Industry must solve the problem by organizing industrial groups charged with the responsibility and given the authority to regulate the functioning of the individual units. The idea of a planned national economy of comprehensive guarantees of security to the individual is absurd. There is not likely to be any revolutionary new industry comparable to the automobile after the last war. Research should deal more with the problem of lessening the spread between factory costs and consumer prices. The movements of population should be studied for their effect on postwar business. **II.** *Ibid.*, [6] 700–703.—L. considers the relationship of democracy and socialism after the war. Among the major factors in postwar business may be the housing shortage, the shortage of durable goods, and the necessity for deferred maintenance. The past four wars in which the U. S. has been engaged are reviewed. The extent of the postwar income is considered, as well as the effect of business expansion in foreign countries due to the war. E.D.M.

Lubrication of industrial coal-burning equipment. ANON. *Lubrication*, **28** [10] 113–24 (1942).—The proper lubrication of stokers and coal-pulverizer equipment, as recommended by the Texas Co., results in efficient and maximum power output. H.E.S.

Materials, old and new. E. FRANKLAND ARMSTRONG. *Jour. Roy. Soc. Arts*, **90** [4608] 228–35 (1942).—During 1942 the Royal Society of Arts, London, conducted a series of twelve lectures entitled "The postwar home: its interior and equipment." In the third address of the series the evolution of materials used inside the house was discussed. Wood and textiles have been available since very early times; pottery came later, earthenware first, followed by china and glass. In the house of the future glass should be more generally used. The large Victorian mirror has disappeared, leaving the rooms darker. The production of table glass has passed into foreign hands, largely because of cheapness; this industry must be made

British again. Glass will soon be more widely used as a building material. Glass leads to ceramics. The industry continues to progress, although it does not have the same scope for new materials. There will be developments in enameled ware, as indicated by the pleasing appearance of the modern gas cooker. K.R.

Measurements of concentrations of air-borne dusts. T. Bedford and C. G. Warner. *Jour. Ind. Hyg. & Toxicol.*, **24** [10] 315–21 (Dec., 1942).—Concentrations of fibrosis-producing dusts in industry can be estimated in terms of the mass concentration of dust or by the number of particles in a unit volume of the dust cloud. Mass concentration expresses more accurately the total dust quantity in the air. The particle count offers a better index of the dust hazard in a dusty operation. Size distribution of particles has great hygienic importance. Very large dust particles have probably little pathologic result but a great effect on mass concentration. In a survey of anthracite mines in South Wales, the authors determined dust concentrations by both methods. Dust present in nodules of a silicotic anthracite miner showed more than 50% of particles smaller than 1 μ; less than 40% were between 1 and 3 μ in size; the largest particles were 8 μ in diameter. Size frequency of dust particles in lung sections resembled the average size distribution of dust in the air of anthracite mines. In literature cited there is general agreement that small particles are more injurious than large ones, Mavrogordato alone claiming that the finest particles exert an influence proportional to their weight, the mass distribution of dust being more important than the size frequency of particles. The authors seek to establish a correlation between the particle count and mass concentration as a measure of value for both methods. If particles in a dust cloud were of the same material and of uniform size, mass concentration would be exactly proportional to numerical concentration, and neither method would have any special advantage over the other. As many variations in size, composition, and kinds of particles coexist in a given dust cloud, however, and methods of selection of samples vary so greatly, the correlation between these two methods can only be low between total mass concentration and the sum of particles up to 5 μ only. Possible relationships arising in this problem are shown in two tables and three graphs. The authors conclude that more accurate information can be obtained by the readier method of counting the particles larger than 1 μ in diameter as a basis for engineering control. 12 references. K.R.

More about patents, trademarks, and copyrights. Leo T. Parker. *Combustion*, **14** [8] 46–49 (1943).—The procedure relating to labels, trademarks, copyrights, and patents is reviewed, and the law is clarified in each case. See "Judge . . .," *Ceram. Abs.*, **21** [6] 135 (1942); "Law . . .," *ibid.*, [11] 250; "Guide . . .," *ibid.*, **22** [3] 64 (1943). H.E.S.

New chemicals for industry. Anon. *Chem. Industries*, **51** [4] 573, 575–88, 606, 608 (1942).—A list of almost 400 new chemical products introduced during 1940–1942 with their properties, uses, and the name of the company producing them is presented. E.D.M.

Patent forum. R. B. Fiske. *Chem. Industries*, **52** [1] 30–33 (1943).—The patent bills currently before Congress are discussed. F. opposes them and suggests the following reforms in the American Patent Law: (1) Before patents are issued the claims should be published and anyone afforded an opportunity to present evidence of prior art, public use, or other reason for denying the patent; thus the Patent Office would have the benefit of painstaking searches made by specialists in their fields and a higher standard of patents should result. (2) The Patent Right should be dated from the date of filing of the application. (3) There should be a system of taxation for the maintenance of patents which would result in many useless and obstructive patents being allowed to lapse. (4) A single Court of Patent Appeals should be established, and technical advisers for the court should be provided. Eric C. Kunz. *Ibid.*, pp. 33, 78, 107.—K. suggests for the chemical industry a system whereby all patent applications would be tested by competent chemists. A separate patent court would also eliminate the necessity for patent lawyers and thus reduce the cost of obtaining a patent. E.D.M.

Pennsylvania anthracite as a filter medium. H. G. Turner. *Ind. Eng. Chem.*, **35** [2] 145–47 (1943).—Filter capacities have been increased 25 to 100% through the use of anthracite as a filter medium. Pennsylvania anthracite is used in municipal filters, power-plant filters for the hot-process softening of waters and for oil removal from boiler condensates, swimming-pool filters, filters for the clarification of chemicals, and sewage filters. Illustrated. F.G.H.

Pfizer opens new building. G. O. Cragwall and W. H. Staebner. *Chem. Industries*, **51** [4] 512–15 (1942).—A modern laboratory building is described, including some construction and engineering details. 14 illustrations. E.D.M.

Pneumoconiosis encountered in bituminous coal miners. R. H. Jones. *Jour. Amer. Med. Assn.*, **119**, 611–15 (June 20, 1942); abstracted in *Jour. Ind. Hyg. & Toxicol.*, **24**, 161 (Oct., 1942).—During a 4-year period, 86 cases of silicosis were discovered in a group of miners of bituminous coal, the only known dust hazard of this series of cases. Results of all characteristic tests enabled classification of these workers under stage 1, 2, or 3 of silicosis. Six typical case histories are presented, two with autopsy findings. J. concludes that silicosis in coal miners is not a rare disease and that "miners' asthma" and anthracosilicosis are the same disease. The disability is not in proportion to the total number of years of employment but depends more on the particular work of the miner affected. Machinemen, motormen, and drillers are most involved. K.R.

Pneumoconiosis in the talc industry. F. W. Porro, J. R. Patton, and A. A. Hobbs, Jr. *Amer. Jour. Roentgenol. & Radium Therapy*, **47**, 507–24 (April, 1942).—Fifteen cases of disabling pneumoconiosis occurring in two talc-producing companies, Ogdensburg, N. Y., with 5 post-mortems, are discussed in detail. Every case history shows exposure to talc dust (silicates) to be chronologically related to the onset of such symptoms as dyspnea, cough, chest pain, weakness, and low vital capacity, as tested with the spirometer. Compared with free silica, the silicates (other than asbestos) have received little attention as possible occupational hazards. Little effort has been made to incriminate them, and their pathogenicity has been denied. In reviewing the literature from 1927 to the present, however, the authors uncover more and more evidence of disability from exposure to silicate dusts. The nature of the dusts, pathology, roentgenographic findings, diagnosis, complications, and prophylaxis in the 15 cases are discussed. It is concluded that pneumoconiosis causing disability and death does occur in talc workers. The disabling tissue changes are due principally to the talc itself. 20 references, 2 tables (clinical summary and autopsy findings), 17 photomicrographs. K.R.

Power, steam, and other services at Willow Run. Anon. *Combustion*, **14** [7] 28–32 (1943).—A brief description is given of the various service units, including power and steam, of the Willow Run Bomber Plant of the Ford Motor Co. H.E.S.

Preventing heavy metal poisoning. William M. Pierce. *Chem. & Met. Eng.*, **49** [9] 141–43 (1942).—Symptoms, effects, and occurrences of lead poisoning are discussed. The tendency of lead to be stored up in the bones and to be subsequently released when the body is least able to cope with it renders its absorption always a potential danger. Samples of lead dust may be obtained with a Greenburg-Smith impinger and lead fumes with an electric precipitator. Fifteen steps to be taken for control of lead dusts and fumes are mentioned. B.C.R.

Prevention of water-side deposits in recirculating cooling systems. W. H. Thompson and J. W. Ryznar. *Combustion*, **14** [5] 41–46 (1942).—The factors affecting the formation of insulating deposits and corrosion on the water side in recirculating cooling water systems are discussed.

Studies on the effect of various treatments for scale and corrosion prevention and for control of biological growths have been made with emphasis on the elimination of calcium and magnesium deposits. The correct evaluation of all factors makes it possible to predict the behavior of any water used under any specific operating conditions. H.E.S.

Proper care of rubber gloves. ANON. *Chem. Industries*, **51** [6] 746 (1942).—11 illustrations. E.D.M.

Public health and medical relationships in industrial health. ORLEN J. JOHNSON. *Amer. Jour. Pub. Health*, **32** [10] 1157–63 (1942).—Absenteeism of workers has increased 10% in defense plants. The resultant economic loss to the employer warrants the adoption of some type of preventive procedure, rather than dependence solely on a plan of treatment. Particular attention should be paid to those who are prone to sickness, usually a small group but accounting for the greater proportion of the absenteeism. A proper medical-service plan for the smaller plants employing less than 500 requires the cooperation of the local medical profession. In some arrangements, the physician calls at the plant at stated hours, acquainting himself with working conditions, giving health lectures, first-aid instruction, and physical examinations, and supervising plant hygiene, etc. B.C.R.

Recent experiments with gray-iron synthetic molding sands. FULTON HOLTBY AND H. F. SCOBIE. *Trans. Amer. Foundrymen's Assn.*, **48** [3] 465–80 (1941).—The occurrences and properties of the St. Peter's sandstone found throughout the Midwestern States are given. This sand can be used as a base for synthetic molding sand as well as for core sand. Fines removed from molding sands of high permeability can be used as molding sands of lower permeability and as blending sands to control the properties of molding sands of similar composition. H.E.S.

Recirculation of fly ash in boiler furnaces. HUDSON H. BUBAR. *Combustion*, **13** [7] 33–35 (1942).—As it results in poorer furnace conditions and increased loading of the gases discharged from the stack, recirculation of fly ash is seldom, if ever, desirable with pulverized-coal installations. With proper design of furnace and burners to provide adequate turbulence and with proper operation, the need for such recirculation disappears. With stokers, however, there may be conditions where the recirculation of cinders is justified. H.E.S.

Reduction of induced-draft fan erosion. R. L. LINCOLN. *Combustion*, **14** [9] 30–33 (1943).—Under present conditions, the necessity for operating at high ratings and often with coals that are high in ash content tends to increase the erosion of induced-draft fans. The erosive characteristics of ash with different forms of firing are discussed, and suggestions are offered for measures that will materially reduce such erosion and divert it to those areas that are readily replaceable instead of to the high-speed, heat-treated rotating member which must be maintained in perfect balance. H.E.S.

Research accounting. DANIEL H. SHEEHAN AND F. J. CURTIS. *Ind. Eng. Chem.*, **35** [2] 225–26 (1943). F.G.H.

Research and patents. ROBERT E. WILSON. *Ind. Eng. Chem.*, **35** [2] 177–85 (1943).—W. discusses in detail the practical workings of our patent system. F.G.H.

Review of the ceramic industry and developments for 1941–42. G. A. KIRKENDALE. *Jour. Can. Ceram. Soc.*, **11**, 4–11 (1942).—K. reviews the ceramic developments with particular reference to those of Canada. Refractory industries report increased production. A process for the recovery of magnesia from brucitic limestone is in operation. Refractory insulating brick are being used as much as possible to replace firebrick in heat-treating furnaces. Optical glass for instruments of all types is being produced, as well as woven glass textiles, plate glass, and bottle glass. Standardization of heavy clay products is being considered. In the whiteware industries, floor and wall tile are being produced for defense construction, dinnerware for the army, insulators for radio apparatus, and steatite bodies for high-frequency radio. Other new developments include the substitution of domestic china clay for imported clay where possible, as well as other raw materials such as talc, pyrophyllite, bond clays, bentonite, and silica sands. G.A.K.

Scaling of boilers: IV, Identification of phases in calcium silicate scales. L. M. CLARK AND C. W. BUNN. *Jour. Soc. Chem. Ind.* [London], **59** [8] 155–58 (1940).—Xonotlite ($5CaO \cdot 5SiO_2 \cdot H_2O$) and pectolite ($Na_2O \cdot 4CaO \cdot 6SiO_2 \cdot H_2O$) have been identified by X-ray and microscopic technique in siliceous boiler scales. These minerals have been synthesized by Nagai's technique to study their solubility relationships. See *Ceram. Abs.*, **18** [5] 141–42 (1939). L.R.B.

Scientific welding applied to plant maintenance. C. W. BRETT. *Claycraft*, **16** [4] 125–29 (1943).—With replacement parts for machinery difficult to obtain, it is often necessary for plant maintenance to make repairs. B. describes urgent repairs of such machines as gravity conveyers, tip wagons, and locomotive crankshafts. G.A.K.

Silicosis in a chert miner. C. W. EVANS. *Brit. Med. Jour.*, **1942, II** [Nov. 28] 636.—Chert is a hard rock or flint stone containing amounts of silica varying from 30 to 90%, found and mined chiefly at Bakewell, Derbyshire, England, and used for grinding pottery materials. E. describes the case of a chert miner who was exposed for over thirty years to much dust. When first X-rayed, his chest showed a perfect picture of silicosis. He complained of dyspnea, cough, sputum, and great fatigue. At no time was there a suspicion of a tubercle. The case is claimed as the first undisputed instance of silicosis due to chert. K.R.

Silicosis: occurrence and control. WILLIAM M. PIERCE. *Chem. & Met. Eng.*, **49** [11] 110–12 (1942).—Silicosis develops conditions resulting in (1) lessened capacity for work, (2) shortness of breath, (3) increased susceptibility to tuberculosis, (4) characteristic X-ray findings, (5) a progressive condition not dependent on continued exposure, and (6) inability to combat tubercular infection once it is acquired. Solubility of 325-mesh quartz in 100 ml. of water was decreased from 50 to 1.9 p.p.m. by the addition of 1 mgm. of fine aluminum dust. The addition of aluminum dust to dusts high in free silica results in a greatly decreased rate of silicosis. Cases are cited where silicosis has caused death six to thirty years after contact with free-silica dusts. Methods of sampling, control of dusts, and necessary precautions to be taken are reviewed. B.C.R.

Spark test for classifying metals. ANON. *Metals & Alloys*, **16** [2] 266 (1942).—Illustrations and descriptions of typical spark streams are given for wrought iron, machine steel, carbon tool steel, gray cast iron, white cast iron, annealed malleable iron, high-speed steel, manganese steel, stainless steel, tungsten-chromium die steel, nitrided nitralloy, Stellite, cemented tungsten carbide, and nickel. See *Ceram. Abs.*, **20** [11] 255 (1941). B.C.R.

Steam separator. W. F. SCHAPHORST. *Chem. Industries*, **51** [4] 558 (1942).—For turbine, engine, and other uses, clean steam is very essential in these days of high steam velocity, high temperatures, and high pressures. A steam separator designed to eliminate moisture also eliminates the dirt, as only the water in the steam carries the impurities. It also eliminates slugs of water which may strip blades in turbines, etc. There is also a thermal saving, as superheat can be increased 17° for every 1% of moisture removed. E.D.M.

Steel at war. ANON. *Ind. Bull. of A. D. Little, Inc.*, No. 187, p. 3 (March, 1943).—Steel-ingot production has increased 60% since 1939, and although its "center of gravity" is unchanged its frontiers are reaching out to Texas and California. A large high-grade iron-ore deposit near Cedar City, Utah, and ore from the mountains of the Southern California desert are supplying raw materials for western expansion. Long-known, large deposits of low-grade ore in Texas are to be concentrated and used as a beginning for an iron and steel industry. A 240% increase in alloy-steel production since 1939 has required development of leaner alloys, known as NE or National

Emergency steels. The addition of boron and its substitution for the more critical alloying agents such as nickel, chromium, and molybdenum have proved to be of some value. H.E.S.

Stock records and control. R. H. WILSON. *Bell Lab. Record*, **20** [1] 15–19 (1941).—W. discusses new methods and records and special machines for posting draw-out records which determine the most economical amount of stock to order and find the minimum quantity at which stock should be reordered so that out-of-stock conditions can be controlled economically. P.S.D.

Superheat as a factor in the design of steam-generating units. L. J. MARSHALL. *Combustion*, **14** [7] 33–35 (1943).—From the turbine designer's standpoint, a wide range of superheat control is desirable. What this involves, especially where other limiting conditions are specified, is pointed out, and the relation of superheat temperature to the various factors entering into the design of a steam-generating unit is discussed broadly to better acquaint the user with some phases of the problem where high steam temperatures are concerned. H.E.S.

Using carbides on large machines. FRED. W. LUCHT. *Can. Machinery*, **53** [8] 84, 86 (1942).—The stepping up of production on large machines has led to increased use of carbide tools. They can be profitably applied to the newer, higher speed machines. E.D.M.

Why industrial dust control is necessary. C. A. SNYDER. *Occupational Hazards*, **5** [2] 9 (1942); *Can. Machinery*, **53** [11] 94 (1942).—Dust should be controlled because it can be a nuisance, a health hazard (silicosis, etc.), and explosive and because it may have value, e.g., gold dust, carbon black, etc. The comparative sizes for ten types of dust particles are as follows:

Size (μ)	Size (in.)	Screen size	Typical material
0.2	0.00000788		Tobacco smoke
1.0	0.0000394		Bacteria
1–5	0.0000394–0.000197		Paint pigments, optical rouge
10	0.000394		
35	0.00138		Pollens, cement dust
50	0.00197	300	Talcum powder
75	0.00295	200	220-mesh ores, human hair
100	0.00394	150	Some ceramic raw materials
1000	0.0394	18	Ordinary pinhead
4000	0.1576		Some BB shot

M.HA. + E.D.M.

Women in the clay products industry. ANON. *Clay Prod. News*, **16** [1] 9 (1943).—Women now do many jobs in a large brick and tile plant in Alberta. They can work at the brick machines, handle ware on the off-bearing belt, move tile from kiln to stock yard, and set brick in the kilns. Women are quick to learn and are efficient in performing various jobs. G.A.K.

SEPARATE PUBLICATIONS

Coal Miners' Safety Manual, a Handbook for Miners. J. J. FORBES, M. J. ANKENY, AND FRANCIS FEEHAN. Published by U. S. Bureau of Mines, 1942. 218 pp. Superintendent of Documents, Washington, D. C. Price 25¢.—More than 800 questions and answers are given covering all phases of safety in mining. R.A.H.

QUALITY BALL CLAYS
PRODUCE BETTER WARE

Write us for samples and complete information
on Ball Clays, Sagger Clays and Wad Clays,
also our Sagger Clay Mix.

KENTUCKY CLAY MINING COMPANY, INC.
MAYFIELD, KENTUCKY

THE BULLETIN SECTION

Volume 22 May 15, 1943 **Number 5**

EVERETT TOWNSEND

DEVELOPMENT OF THE TILE INDUSTRY IN THE UNITED STATES*

By Everett Townsend

I was born in East Orange, New Jersey, December 17, 1866. When I was sixteen years of age, my parents moved to Brooklyn, New York. My father, A. S. Townsend, was manager of the Atlantic White Lead and Linseed Oil Company located on the East River, next to the Brooklyn Navy Yard.

I attended Public School Number 13 until I was nineteen. Then I decided to go to work. I had a cousin who manufactured hatters' trimmings in New York City, so on September 1, 1885, I went to work for this cousin as a bookkeeper (single entry).

I soon found that my cousin was in financial difficulties. My father offered to advance the necessary capital to take over the business, providing the cousin would stay on a salary basis and run the business. This he agreed to do, so in my twenty-second year I put a sign in front of my office at 27 West Houston Street, which read: Everett Townsend, Hatters' Trimmings.

This arrangement did not pan out very well, and in about two years my cousin went with another company. This left me in a dilemma, as I did not feel that I had had enough experience to carry on alone. Charles Whitaker, a spinner who had been making hat cords for me, suggested that he put in money and buy a half interest in the business. This was a happy solution to my problem, so the firm of Townsend and Whitaker was formed. This was carried on for another two years, but the future outlook for the business was not very promising, so the firm decided to liquidate. This was in the latter part of 1891.

I then opened a retail hat store in Trenton, New Jersey. The first year, the venture looked very promising. In 1892, Grover Cleveland was elected President. The banks began to fail in the spring of 1893, one pottery after another closed down, and the great panic of the late nineties ensued. The hat store was doomed to failure.

In the fall of 1894, my father purchased a one-third interest in a tile factory in Morrisville, Pennsylvania (just across the river from Trenton), with the understanding that I would be made the Secretary of this Company, so I closed up the hat store and on January 1, 1895, started my career in the tile industry, which career has covered nearly half a century.

As I am probably one of the oldest men connected with the tile industry, it occurred to me that it would make an interesting story to put in writing some of my recollections of this industry.

HISTORY OF THE TILE INDUSTRY

"Several attempts to produce tile in America were made before the American Revolution, but the output was sporadic and has little more than an antiquarian interest.

"The elaborate display of European tile at the Centennial Exposition at Philadelphia in 1876 greatly stimulated interest in tile manufacture, and in the years immediately following, plants were erected in Trenton, New Jersey; Brooklyn, New York; Boston, Massachusetts; Zanesville, Ohio; Beaver Falls, Pennsylvania; and several other places.

"By 1897, eighteen firms were manufacturing floor and wall tile. By this time, decorating with enamels or glazes, in colors, was being extensively done. A large part of the output, however, was still the early encaustic type, i.e., plain surface vitreous floor tile without superficial coloring, the coloring being due to the inherent firing properties of the clays used.

"Some tile were embossed, or had a raised design imparted to them in molding, and were then covered with a transparent glaze." (1)†

But during these early years, most floor and wall tile was imported from European countries. Herman Petri, a tile contractor in New York City who became connected with the trade in 1888, gives the following information:

"Up until 1890, tile of every description was imported. The Alfred Boote Company handled Maw and Company floor and wall tile, also embossed and decorated tile. Miller and Coates were importers of Minton-Hollin tile. These tile, as well as Maw and Company tile, came from England. Conover and Company handled Brown and Company Paisley wall tile made in Scotland. They also handled imported tile from the Campbell Tile Company, Stoke-on-Trent, England.

"These early contractors were principally dealers in mantels and fireplace furniture and imported tile for hearths and facings. A tiled bathroom in those days was a curiosity and was installed only by the very wealthy.

"The first factories in the United States made mostly encaustic floor tile and installed them. But by about 1890 the tile factories gave up installing tile and sold their output through tile dealers. The installation in those days was often crudely done, but today setting tile requires expert workmanship." (7)

The floor tile made before 1890 was mostly $1/2$ inch thick and, in large sizes, 4 by 4 and 6 by 6 inches square. Shortly after 1890, ceramic mosaic tile was introduced. This tile was only $1/4$ inch thick and was mostly made in $3/4$-inch squares or 1-inch hexagons. These tile were pasted on paper about 12 inches wide to 24 inches long. They were made in white vitreous as well as a full line of colors.

"When I (Herman Petri) started in the tile game in 1888, I have no recollection of any white wall tile being made in the United States." (7)

* This history was completed November 1, 1942; additional 1943 data have been added since the material has been in type; the numbered footnotes have been added by the Editor.

† Numbers in parentheses refer to the numbered list of persons and publications from which information was obtained (see p. 151).

Companies Organized before 1900

(1) American Encaustic Tiling Company, Zanesville, Ohio, 1875.
(2) Star Encaustic Tiling Company, Pittsburgh, Pennsylvania, 1876.
(3) United States Encaustic Tile Works, Indianapolis, Indiana, 1877.
(4) Low Art Tile Company, Chelsea, Massachusetts, 1879.
(5) Wheatley Pottery Company, Cincinnati, Ohio, 1879.
(6) Trent Tile Company, Trenton, New Jersey, 1882.
(7) International Tile and Trim Company, Brooklyn, New York, 1882.
(8) Beaver Falls Art Tile Company, Beaver Falls, Pennsylvania, 1886.
(9) Columbia Encaustic Tile Company, Anderson, Indiana, 1887.
(10) Cambridge Tile Manufacturing Company, Covington, Kentucky, 1889.
(11) Robertson Art Tile Company, Morrisville, Pennsylvania, 1890.
(12) Grueby Faience and Tile Company, Boston, Massachusetts, 1891.
(13) Providential Tile Company, Trenton, New Jersey, 1891.
(14) Maywood Tile Company, Maywood, New Jersey, 1891.
(15) Alhambra Tile Company, Newport, Kentucky, 1892.
(16) Kirkham Art Tile Company, Barberton, Ohio, 1892.
(17) Mosiac Tile Company, Zanesville, Ohio, 1893.
(18) Old Bridge Enameled Brick and Tile Company, Old Bridge, New Jersey, 1893.
(19) Penn Tile Works Company, Aspers, Pennsylvania, 1894.
(20) C. Pardee Works, Perth Amboy, New Jersey, 1894.
(21) Hamilton Tile Company, Hamilton, Ohio, 1894.

In addition to the companies just named, there were four other small companies which started before 1900. The years they began is not known, but their existence was probably of short duration.

(22) Ceramic Tile Works, Toledo, Ohio, failed 1892.
(23) McKeesport Tile Company, McKeesport, Pennsylvania, failed 1895.
(24) Tarrytown Tile Company, Tarrytown, New York, failed 1900.
(25) South Amboy Tile Company, South Amboy, New Jersey, failed 1900.

Before 1890, about all of the floor tile made was the so-called encaustic tile, made from natural-firing red and buff clays. The glazed tile, called faience tile, were fire-clay bodies coated with colored raw lead glazes.

Between 1890 and 1895, white vitreous floor tile appeared, as well as vitreous colors.

About this same time, colored glazes on a white body came on the market and were used principally for hearths and facings for mantels.

Mat or satin-finished glazes were not used much before 1900, but Will Landers of the United States Encaustic Tiling Company claims that he made a mat glaze in 1893 and that it was used on a building in Indianapolis.

Mr. Rivers of the Old Bridge Enameled Brick and Tile Company was one of the first to use a pink or ox-blood glaze. About 1898, he gave me his recipe for making pink and ox-blood stains.

Ceramic floor tile appeared about 1895, and the New York Vitrified Tile Company, the Trent Tile Company, and the American Encaustic Tiling Company seem to have been the first companies to make this class of tile.

American Encaustic Tiling Company, Zanesville, Ohio

This Company was the pioneer in the United States in floor- and wall-tile production. It was founded by Benedict Fischer in 1875 and was incorporated in 1878, with Mr. Fischer as its first President.

Benedict Fischer

The plant began small but it grew rapidly, so in 1890 they decided to build an entirely new factory which was way in advance of any factory making tile in that day. The old plant was then abandoned.

George Stanbury was Manager for many years. Herman Mueller, an outstanding figure in the tile industry, was employed by them in 1886.[1] For three years (1890–1893), Karl Langenbeck was their chemist. He introduced Parian vitreous bodies. (5)

This Company was the first to manufacture white wall tile in the United States (1895).

Mr. Fischer remained as President until his death in 1903, when John Hoge, of Zanesville, Ohio, succeeded him.

In 1910, the size of their factory was increased one third. They were the first to install a tunnel kiln (Dressler) in the tile industry.

Mr. Stanbury died about this time, and Harry D. Lillibridge succeeded him as Manager.

---

[1] See *Bull. Amer. Ceram. Soc.*, **21** [1] 1–3 (1942).

In 1912, they purchased a factory in Maurer, New Jersey (see Atlantic Tile and Faience Company, p. 143), and in 1919 they secured a branch factory in California. "In 1919, the American Encaustic Tiling Company purchased the West Coast Tile Company at Vernon (now part of Los Angeles) and placed Frank Philo in charge thereof (see p. 149). Operations under Mr. Philo's management were successful, and the plant expanded to more than double its original size in the next few years." (33)

Mr. Hoge died in 1920, and Emil Kohler, Mr. Fischer's son-in-law, became President.

"The American (about 1922) leased a large office building at 16 East 41st Street, New York City, and later purchased and renovated it to fit its needs." (27)

Mr. Kohler died in 1924, and Mr. Lillibridge died in 1926 [2]

Just before Mr. Lillibridge's death in Los Angeles, the Company purchased another factory at Hermosa Beach, owned by the Proutyline Products Company (see p. 149). The date of this purchase was July 29, 1926.

"From that date until 1933, the American Encaustic Tiling Company continued to operate two plants in this area, the Vernon plant manufacturing ceramics and clay-bodied tile, and the Hermosa plant manufacturing Hermosa tile, which was the talc-body type of tile." (33)

Mr. Philo was placed in charge of this operation, as well as the then existing Vernon operation, for the American Encaustic Tiling Company.

In 1930, the American Encaustic Tiling Company with their large Zanesville plant and three branch factories "constituted the largest tile industry in the world, and Benedict Fischer's estate was the principal owner." (27)

The President at this time was C. E. Diefenthaler. The Company, during the depression of 1932, got into financial difficulties.

"About August, 1933, they concluded a deal with Gladding, McBean & Company of Glendale, California (see p. 149), to purchase all of the West Coast operations, which included the Vernon and Hermosa factories." (33)

"As their financial position did not improve, they borrowed $500,000 from the Reconstruction Finance Corporation (RFC). This government loan did not get them out of their troubles, so in 1936 there was a reorganization with Malcolm A. Schweiker as President and Manager of the Company." (11)

This reorganization only kept them going a little while. The government then stepped in to protect their loan, placing Malcolm A. Schweiker in charge to liquidate the Company. He disposed of all of the stock and sold the Zanesville factory to the Shawnee Pottery Company.

Mr. Schweiker, with several others, bought the factory at Maurer, New Jersey (see p. 143).

Star Encaustic Tiling Company, Pittsburgh, Pennsylvania

"The first successful attempt to produce floor tile was n 1867 by Samuel Keyes, an Englishman, who started to experiment with the manufacture of tile while managing a brickworks at Pittsburgh, Pennsylvania. By 1871, he had produced floor tile which received favorable recognition.

"The business started in 1876 as the Pittsburgh Encaustic Tile Company, Limited, with Mr. Keyes as Superintendent, and was reorganized in 1892 under the name of the Star Encaustic Tiling Company." (1)

A Mr. Aldrich was the Manager and principal owner. It was a very small plant and made only floor tile from red- and buff-firing clays. This Company was out of existence by 1905.

United States Encaustic Tile Works, Indianapolis, Indiana

"This plant was founded September 18, 1877, by William Harrison, a cousin of President Benjamin Harrison. They went into receivership in 1886 when Mr. Harrison's bank (affiliated with the tile company) failed.

"On May 10, 1886, the United States Encaustic Tile Works was formed and took over the former Company. This last firm consisted of John J. Cooper, Sr., President; William Picken, Vice-President; and Jackson Landers, Secretary and Treasurer. By 1916, these three original owners had died and had been succeeded by Charles M. Cooper, William F. Landers, and William N. Picken.

"The Company originally made unglazed floor tile. They later began glazing these in bright colors for mantels. This apparently was the prosperous time for the tile business, as they received high prices and costs were low. They later made all kinds of ceramics and white and colored wall tile.

"Will Landers claimed that he had made the first mat finish glaze in the United States in 1893 and used it to glaze all of the brick used in what was then a prominent Indianapolis hotel just north of the State House. Underneath the dirt and grime, the mat glaze is still holding well. Mr. Landers said he made the glaze especially for this old hotel, but none of the tile trade liked it until years later, when the United States Encaustic Tile Works again introduced it.

"Mr. Cooper relates that they made encaustic tile about 2 or 3 inches square that had a recessed place in the center to hold either a silver dollar or a $10 or $20 gold piece. These coins were cemented in the tile and the top of the coin was flush with the face of the tile. Some time in the 1890's, when Fort Worth, Texas, was small and a western outpost for cattlemen and cowboys, a very fine saloon was built with a floor of U. S. Encaustic floor tile which contained a great many of these $1, $10, and $20 gold pieces. In all, many hundreds of dollars were inlaid in the tile of the floor. The place soon became a mecca for cowboys and cattlemen, and of course the townspeople, as everyone wanted to get the thrill of walking on $10 and $20 gold pieces. One morning, a couple of men who seemed to be workmen came into the place with picks and shovels and told the bartender that the proprietor had sent them to take up the floor and install a new floor. They dug up the entire floor and hauled it away in a large wagon drawn by a couple of mules. When the proprietor arrived at noon, his pet floor with all the gold and silver coins was gone. He immediately ordered more tile of the same kind, and again adorned the saloon with a floor 'where you could walk on money.'

"An expansion program, with a new tunnel kiln, was planned two or three months before the crash of October,

[2] See *Bull. Amer. Ceram. Soc.*, **5** [3] 198–99 (1926).

1929. The expenditure of about $125,000, mostly on short-time loan, was primarily the cause of a receivership in October, 1931.

"Charles M. Cooper, William F. Landers, and William N. Picken died between 1931 and 1932.

"The Company was in the hands of a receiver from October, 1931, until December, 1932. The bank was the actual owner of the plant during the receivership.

"A new company was formed in December, 1932, and took the name of the U. S. Tile Corporation.

U. S. Tile Corporation

"The bank held all the stock of this new Corporation. The Company was mostly formed to hold and operate the assets until the plant could be disposed of. The officers of the new Corporation were F. B. Slupesky, President; William B. Schiltges, Secretary; and Evans Woolen, Jr., Treasurer. Mr. Schiltges and Mr. Woolen, Jr., were officers of the bank.

"The U. S. Tile Corporation operated the plant from December, 1932, until December, 1936, at which time they leased the plant and machinery, with an option to buy, to the Cambridge Tile Manufacturing Company, Cincinnati, Ohio. That firm operated the plant for several months and finally gave up the lease in June, 1938, at which time the U. S. Tile Corporation decided to liquidate the plant.

"F. B. Slupesky was engaged to liquidate and dispose of their stock and machinery and he proceeded to do this, beginning July 1, 1938, and had the job completed about May 1, 1939.

"The U. S. Tile Corporation went out of business and was dissolved in 1939, and this Corporation ceased to exist as a corporate entity.

"At the present time, the kilns and buildings are in the process of being torn down and the property will be used as a playground." (17)

"At the time the plant was sold, it consisted of fifteen periodic kilns (ten biscuit and five glost) and one tunnel kiln (glost); the rated capacity of the plant was 3,000,000 square feet annually." (4)

Low Art Tile Company, Chelsea, Massachusetts

To explain the beginning of this Company, I must review the history of the Robertson family, James Robertson and his four sons, who came to the United States from England in 1853.

"Before 1866, Alexander Robertson, son of James Robertson, started a pottery in an old varnish factory in Chelsea. In 1867, his brother, Hugh, joined him, and in 1872 their father, James, became a member of the firm." (19)

"James Robertson wrote that in 1872, besides continuing the faience ware, they produced what he believed to be the first pressed clay tile made in the United States.

"John G. Low was an artist with the Chelsea Ceramic Art Works, where he learned to make tile, and later organized his own company and produced glazed fireplace tile. James Robertson was the man who taught him, and later his son, George W. Robertson (founder of the Robertson Art Tile Company) went to work for the Low Company at the salary of seventy-five dollars per week, which was considered quite a sum in those days. George W. Robertson in 1872 was the first to make pressed-clay dust tile in this country, and tile were made by James Robertson as early as 1860." (13)

Norton[3] lists the Low Art Tile Company as the J. & J. G. Low Company. Starting in 1879 and going out of business in 1890, they made art tile and obtained their clay from Martha's Vineyard.

"The Low Art Tile Company mostly made highly decorated embossed tile chiefly for soda fountains." (7)

Wheatley Pottery Company, Cincinnati, Ohio

"The Wheatley Pottery Company was organized in 1879 by Tom Wheatley. Later, it was operated by Ike Kahn and then controlled by J. B. Swift. Mr. Swift died several years ago, and Ike Kahn passed away about two years ago. This organization produced handmade faience tile, clay chimney pots, and garden furniture in clay. Their establishment was on Reading Road in Cincinnati, but the plant was later moved to a building owned by J. B. Swift.

"In May, 1927, the Cambridge Tile Manufacturing Company acquired the Wheatley Pottery Company, incorporated it as the Wheatley Tile & Pottery Company, and operated the plant at Eastern Avenue, Cincinnati, Ohio (see p. 131). They continued to make faience tile, chimney pots, and pottery.

"The officers of the Wheatley Tile & Pottery Company at this time were Charles H. Burchenal, President; C. M. Doiseau, Vice-President; J. C. Herman, Secretary; and W. S. Berger, Treasurer.

"The Wheatley Tile & Pottery Company continued to be operated as a separate unit by Cambridge, but it was closed down in 1930 and the Wheatley products were continued at the new Cambridge plant in Hartwell, a town nine miles from Cincinnati.

"The Cambridge-Wheatley Company was incorporated in 1927 to sell the products of the Wheatley Tile & Pottery Company and the Cambridge Tile Manufacturing Company.

"The Cambridge-Wheatley Company and the Wheatley Tile & Pottery Company were legally dissolved in December, 1936." (12)

Trent Tile Company Trenton, New Jersey

It is stated in a history of Trenton that the Trent Tile Company was established in 1882 and that they were the original manufacturers of ceramic mosaic tile in white and colors. (37) This history, however, does not tell who the men were who organized this Company. In the early nineties, Benjamin F. Lee became the sole owner and was President of the Company. He, however, took no active part in the business.

Mr. Lee was Chief Clerk of the Supreme Court of the State of New Jersey for many years and retained this office

[3] See "A Check List of Early New England Potteries," compiled by F. H. Norton, *Bull. Amer. Ceram. Soc.*, **18** [5] 181–85 (1939).

until his death in 1905. Mr. Lee had in his office a young man by the name of Alfred W. Lawshe, who was made Treasurer and Secretary. Mr. Lawshe was given charge of the Company. When Mr. Lawshe's son, Charles, left school, he went with the Company and eventually became Superintendent.

By 1910, the Trent Tile Company was one of the outstanding companies in the United States and employed about three hundred persons.

In 1912, the Company ran into financial difficulties and was forced into the hands of a receiver. Thomas Thropp, a member of the firm of the Eureka Flint and Spar Company, of Trenton, was made receiver. Lewis Whitehead of the Providential Tile Company and I were appointed appraisers by the receiver.

When the property was put up for sale in 1916, Mr. Thropp bought it in. He built up a new organization and was the President of the Company, as well as General Manager. After he died in 1931, the family kept the Company going until they could obtain a buyer. During this period Mr. Thropp's son, H. W. Thropp, was President; John C. Wilkes, Treasurer and General Manager; Donald H. Benedict, Secretary and Sales Manager; and Frederick A. Rose, Plant Manager. The factory at this time had twenty-two periodic kilns (twelve biscuit and ten glost) and one continuous tunnel kiln fired with oil. The rated capacity of the plant was 8,000,000 square feet of floor and wall tile annually.

A few years after the failure of the Trent Tile Company, both Mr. Lawshe and his son died.

R. P. Herrold, who at one time was President of the Mosaic Tile Company, received a loan from the RFC and in 1936 bought the Trent Tile Company from the Thropps and took over the management. He operated it until 1939, when it was closed down and taken over by the Government (RFC).

The Company was idle until 1940, when the Wenczel Tile Company, Trenton, New Jersey, purchased the property from the RFC. It is now being operated under the name of the Wenczel Tile Company (see p. 145).

International Tile and Trim Company, Brooklyn, New York

"This Company was organized about 1882 and was financed in England by John Ivory and his father. The stock was mostly held by Mr. Ivory, Sr., and by members of the British aristocracy. John Ivory was Manager; Cyril J. Wilson, Secretary; and Sydney Ivory, Ceramist.

"All presses, dies, and special machinery were brought from England. Many of the workers (all department heads) were brought over, including a printer and engraver.

"At that time the plant was on Third Street, and ran through to Fourth Street, situated in the block between Hoyt and Bond Streets." (36)

Fred H. Wilde, an Englishman, came to the United States in 1885, and he states that the first factory he worked in after coming to the States was the International Tile and Trim Company. He had been employed in England by Maw and Company, one of the oldest tile companies in that country. Maw and Company and Minton-Hollin and Company were the real pioneers and developers of the dust-pressed floor tile.

"About 1886, the English stockholders decided they wanted to dispose of their stock. John Ivory interested John Arbuckle, a member of the firm of the Arbuckle Company (a coffee company), and he bought up the stock held by these Englishmen." (36)

A. M. Tilney (a lawyer) was then made Manager; John Ivory, Superintendent; and Fred H. Wilde, Ceramist.

"It was in a three-story building and was a badly laid-out factory. Between every operation the material had to be moved by an elevator up or down; material was moved from the street floor to a blunger on the second floor, to the sliphouse on the ground floor, etc., finishing up with an assorting room on the top floor.

"After working some months under the new management, I (F. H. Wilde) left this Company and went to the Maywood Tile Company of Maywood, New Jersey." (36)

In 1888, a new company took over the International Tile and Trim Company and called themselves the New York Vitrified Tile Company.

New York Vitrified Tile Company

"The officers of this Company were Mortimer C. Ogden, President; Francis H. Wilson, Vice-President; John H. Lyon, Treasurer; Philip Knight, Secretary; and Arthur H. Bonnell, Manager.

"An Englishman by the name of Plant, who had lately arrived in Brooklyn, was engaged as their ceramist.

"They manufactured only the large sizes of tile, such as 3- and $4^1/_2$-inch octagons, 2- and 3-inch hexagons, $1^1/_{16}$-, $1^1/_2$-, and $2^1/_8$-inch squares, and 3- by $1^1/_2$-inch oblongs, all $^1/_2$ inch thick. These tile were vitreous and semivitreous, in white and colors.

Brooklyn Vitrified Tile Works

"In 1896, the New York Vitrified Tile Company sold out its interest to their Manager, A. H. Bonnell, who formed a new company and changed the name to the Brooklyn Vitrified Tile Works. He had as partners Philip M. Knight and Oscar Zilly.

"In addition to the sizes made by the New York Vitrified Tile Company, they began to manufacture ceramic mosaic, a small-sized tile only $^1/_4$ inch thick.

"I (W. H. Henry) served first as an office man, bookkeeper, etc., and finally was made Manager of the Ceramic Department. Our mounted ceramics were considered to be the best on the market. I discovered a way to make paste that would hold the tile on paper and at the same time could be released in the shortest time on the job.

"On May 15, 1897, A. H. Bonnell obtained a patent on a shape known as Cavex tile. Later I patented a tile called Venetian tile.

"A fire destroyed their entire plant in 1906. After reconstruction and operation were well under way, the panic of 1907 made it necessary to close the plant for a time, and in the meantime A. H. Bonnell passed away.

"A new company using the same name was formed composed of Edward A. Meridan, William Chell, and Oscar J. Zilly. Manufacturing was resumed and continued until the war of 1917, when business was curtailed, and the plant was finally sold out at auction." (16)

Beaver Falls Art Tile Company, Beaver Falls, Pennsylvania

The Beaver Falls Art Tile Company was organized December 30, 1886.

The prime mover in the organization of this Company was Francis W. Walker.

"John Reeves, a banker, was elected President and F. W. Walker was elected Secretary and Treasurer. The Company was first operated as a limited Company in a small way. In 1906, the business was incorporated." (6)

At first, the Company manufactured only so-called enameled tile for hearths and facings; later, they made white wall tile, and finally specialized in white wall tile. Their first kilns were round periodic kilns, but later they installed a Dressler tunnel kiln.

"Mr. Walker sought a close relationship with the Robert Rossman Company of New York City, a jobbing house of long standing, to whom he looked for the sale of most of his production. In 1911, this Company was taken over by the Beaver Falls Art Tile Company and maintained as a sales company." (6)

The Robert Rossman Corporation formed in 1927 (see p. 146) was a merger of the Beaver Falls Art Tile Company and two other tile companies. Thus ended the career of the Beaver Falls Art Tile Company. Francis W. Walker died in 1933.

Columbia Encaustic Tile Company, Anderson, Indiana

"The Columbia Encaustic Tile Company was organized in 1887 by B. O. Haugh and George Lilly. Louis E. Lathrop became interested later. The officers of the Company when the National Tile Company was formed in 1903 were B. O. Haugh, President; George Lilly, Vice-President and Treasurer; and Harry Haugh, Secretary" (10) (see the National Tile Company, p. 141).

Cambridge Tile Manufacturing Company, Covington, Kentucky

"In 1885, the Cambridge Tile Manufacturing Company was located at the northeast corner of 16th and Woodburn Avenue, Covington, Kentucky. This was then a common red brickyard operated by Busse Brothers. Heinrich Binz, a German tilemaker employed by Busse Brothers, glazed some building brick for exterior decorative purposes and at the same time made a glazed tile in colors.

"In 1886, Busse Brothers started to sell enameled tile and called the plant the Mount Casini Art Tile Company.

"In 1887, a sales company called the Cambridge Art Tile Company was organized.

"In 1889, the Company was incorporated as the Cambridge Tile Manufacturing Company under the laws of the State of Kentucky. The officers were Henry Busse, President; Herman Busse, Treasurer; and F. W. Braunstein, Secretary.

"The products manufactured at this time were bright glazed colored enameled tile, decorated tile, circular teapot stands in colors, and colored tile used for decorating the exterior of heating stoves.

"In 1890, the capital stock was increased and again in 1891.

"In 1894, the Company started to manufacture, in addition to the tile products, common red flowerpots, clay flue linings, and clay carboy stoppers. The World War shut off this business because of lack of fuel.

"In 1899, the Company started to make white glazed wall tile.

"In 1900, the Company began making white and colored vitreous floor tile, white ceramics in 1- and $1^1/_4$-inch hexagons and $^3/_4$-inch squares, and bright glazed faience called Kenton Vitrea brick. Faience flat and a few trims were made, as well as faience mantels with wrought-iron trimmings.

"In 1901, $^{13}/_{16}$-inch round ceramics were in vogue and this Company held a royalty contract for the manufacturing of this product and made it for several years. In 1905, they made considerable art ceramic mosaics and had a special department for this class of work.

"In June, 1906, the Kentucky company was dissolved. The Cambridge Tile Manufacturing Company was incorporated under the Ohio laws with a new capital structure. The officers in the new company were A. W. Koch, President; F. W. Braunstein, Secretary; and C. F. Koch, Treasurer.

"The Company started to make mat tile in 1906.

"In 1912, the management changed. F. W. Braunstein bought the stock of the Koch brothers and secured controlling interest. The officers then were F. W. Braunstein, President and Treasurer; Frank Braunstein, Vice-President; and W. S. Berger, Secretary.

"In 1920, F. W. Braunstein passed away, and W. S. Berger became President; C. B. Braunstein, Secretary; and E. T. Rutley, General Manager.

"In 1927, Charles H. Burchenal became President; C. M. Doiseau, Vice-President; W. S. Berger, Treasurer; and John C. Herman, Secretary. The old plant at Covington, Kentucky, with about twenty periodic Bittle kilns, was scrapped. The plant site is now cleared off and nice residences erected thereon.

"In May, 1927, the Wheatley Pottery Company was acquired by the Cambridge Tile Manufacturing Company (see p. 129). A new organization was set up in June, 1927, and the corporate name was changed to the Wheatley Tile & Pottery Company, with its manufacturing plant on Eastern Avenue, Cincinnati, Ohio. The officers of this Company were C. H. Burchenal, President; C. M. Doiseau, Vice-President; J. C. Herman, Secretary; and W. S Berger, Treasurer.

"This site was given up in June, 1931, and all manufacturing was done at the plant of the Cambridge Tile Manufacturing Company. Their products, however, were not in demand and the Company dissolved in December, 1936.

"Early in 1929, twenty acres of land were purchased at Hartwell, Ohio, for the erection of a new modern daylight continuous-process tile manufacturing plant. The building is fireproof and equipped with modern machinery throughout. There are two Harrop tunnel kilns. The Baltimore and Ohio Railroad has a switch track to the plant.

"In November, 1929, the new plant was in operation, and the office staff moved into its new quarters from Covington, Kentucky. Officers were C. H. Burchenal, President; C. M. Doiseau, Vice-President; J. C. Herman, Secretary; and W. S. Berger, Treasurer.

"The officers as of April 17, 1942, are C. H. Burchenal, President; H. E. Meyer, Vice-President and Secretary; W. S. Berger, Treasurer; and C. J. Hayes, Assistant Treasurer." (12)

The plant now consists of three periodic kilns (biscuit)

and two tunnel kilns (one biscuit and one glost). Fuel—gas and oil. It has a rated capacity of 5,000,000 square feet annually.

Robertson Art Tile Company, Morrisville, Pennsylvania

This Company was founded by George W. Robertson in December, 1890. Before his buildings and kilns were completed, Mr. Robertson ran out of funds. In constructing his kilns and buildings, he had been buying firebrick and other materials from the Trenton Fire Clay and Porcelain Company, Trenton, New Jersey, which was owned and operated by O. O. Bowman and his two sons, Robert and William.[4] Mr. Robertson appealed to these gentlemen for financial help. W. J. J. Bowman suggested to Arthur D. Forst, his brother-in-law, that this was a good opportunity to invest some money. Mr. Forst agreed to put in the necessary capital, providing the Bowmans would take stock in the new company for the amount of money Mr. Robertson owed the Trenton Fire Clay and Porcelain Company. This they agreed to do.

A company was then organized and took the name of the Robertson Art Tile Company, with A. D. Forst, President; R. K. Bowman, Treasurer; and George W. Robertson, Superintendent.

After the death of his son, James, in 1893, Mr. Robertson lost interest in the business and offered his stock for sale. R. K. Bowman told my father, A. S. Townsend, that this stock was for sale and that if he would purchase it they would make me (R. K. Bowman's brother-in-law) Secretary of the Company.

I was appointed Secretary January 1, 1895, and my father was appointed Vice-President.

Mr. Robertson agreed to stay six months to teach someone how to prepare the body and glazes and fire the kilns. As Mr. Forst was going to look after the manufacturing, he received these instructions.

Mr. Forst was troubled greatly with asthma, and after three years in the factory decided he could no longer attend to this end of the business. It was suggested that I be made Superintendent and Mr. Forst take over the selling. This was agreed to, although I knew practically nothing about making tile.

Mr. Robertson gave us the recipe for only one tile body and a few raw lead glazes. His line of colors was limited to a few bright glazes. His body contained 20% of ground biscuit, and, as our losses were not nearly so great as this, we had to buy broken crockery from the Trenton potteries. This was ground under chaser stones.

Our facilities for manufacturing at this time (1898) were very primitive. We had no sliphouse. The body was weighed on the first floor and dumped into a 6-foot ball mill located in the basement. After grinding, this cylinder was dumped and the contents were elevated by buckets to the third floor. Here we had dozens of small trucks on wheels. These trucks were 5 feet long, $2\frac{1}{2}$ feet wide, and 12 inches deep, with plaster of Paris bottoms 6 inches deep which could be saturated with water. Every afternoon, a 2-inch layer of this pulverized body was put in each truck. It was left overnight to soak, and the next morning it was damp enough for the pressers. Then it was sieved by hand through a round $\frac{1}{8}$-mesh brass sieve into a dust bin on the second floor where the pressroom was located. The pressing was all done by hand, and only one 6- by 3-inch or 6- by 6-inch tile was pressed at a time.

From the pressroom the saggers containing the tile were sent down an inclined track to the biscuit kilns. All saggers were made by hand, as there were no power presses in existence. The tile were fired in a Lawton downdraft kiln with soft coal. To control the heat, we used shrinkage trials made from our body. (Stanley C. Burt, formerly of the Rookwood Pottery, Cincinnati, Ohio, brought the first Seger cones and one of the first electric pyrometers to the United States from Germany in 1894. (18))

The glaze was ground in burr mills which were about 8 feet in diameter and 2 feet high. They were clumsy outfits as compared with today's ball mills.

All of the tile were dipped by hand. Ordinary washbowls contained the glaze, and small paddles kept the glaze from settling.

These tile were also fired with soft coal; the heat of the kiln was regulated by small rings with Albany dip on one side and feldspar on the other. The fireman had to know the exact shade of the Albany dip to determine when the kiln was finished. It was a great day for us when Professor Edward Orton, Jr., put his pyrometric cones on the market.

About 1899, the Crossley Machine Company, Trenton, New Jersey, installed one of their new sliphouses, which included a side-feed filter press with square "cakes." This was a wonderful improvement from previous crude procedure.*

The power plant consisted of a 100-h.p. plain slide-valve engine; all of the machinery was connected to a long main line shaft which made 90 r.p.m. It was some time after 1900 before electric power was used.

In 1885, Fred Wilde, an Englishman, came to the United States. He had been employed in an English tile factory and brought with him recipes for making white wall tile and an extensive line of bright and mat glazes. He also had recipes for pinks and ox bloods.

Mr. Wilde's first position in the United States was with the International Tile and Trim Company, Brooklyn, New York (see p. 130). In the latter part of 1900, he was employed by the Robertson Art Tile Company.

It was not long, therefore, before we had an entirely new line of bright and mat colored glazes and one of the best white wall tile on the market.

Mr. Wilde's white glaze required a frit. As we had no frit kiln at that time, the frit mix was put into a large round sagger, previously coated with flint on the inside, and fired in a glost kiln. After taking it from the kiln, the sagger was broken apart and the flint was cleaned from the glass. Then the frit was broken up and crushed under large chaser stones and sieved by hand through a round $\frac{1}{8}$-mesh sieve.

Mr. Wilde left the Robertson Art Tile Company in the summer of 1903 and went to California, where he started a small tile factory (see p. 148).

From 1903 to 1906, the Robertson Art Tile Company ceased to exist as a separate company, as it went into a

[4] See *Bull. Amer. Ceram. Soc.*, **19** [5] 175–77 (1940) for a history of the Bowmans.

* Joseph Crossley, inventor of this press, died in 1941 at the age of eighty-five.

consolidation which was called the National Tile Company (see p. 141).

The consolidation lasted a little short of three years, when the Robertson Art Tile Company withdrew and resumed its old name.

The new officers were A. D. Forst, President and Treasurer; Everett Townsend, General Manager in charge of manufacturing; and T. R. Cheyney, Secretary, in charge of sales.

While with the National Tile Company, I obtained their recipes for floor-tile bodies. The Robertson Art Tile Company had never made floor tile, so new buildings and equipment were provided to produce this line. W. E. Rivers, Superintendent of the Old Bridge Enameled Brick and Tile Company, assisted in getting production started.

Herman Mueller and the two Grigsbys decided to leave the National Tile Company and come with the Robertson Art Tile Company, Mr. Mueller to promote sales, George Grigsby to do designing and estimating under Mr. Mueller's supervision, and Jim Grigsby to assemble and paste the ceramic floor tile. Mr. Mueller and the Grigsbys stayed five years or until 1908, when Mr. Mueller decided to start a factory of his own (see Mueller Mosaic Company, p. 143).

The Robertson Art Tile Company was now making principally white wall tile (as colored tile was not greatly in demand) and a full line of ceramic floor tile.

During the next twelve years, the business increased, due largely to the fine salesmanship of T. R. Cheyney.

Mr. Forst's older son, D. Parry Forst, joined the Company in 1918. He had been through Mercersburg Academy and Princeton University and had taken the course in ceramics at the Ohio State University. After leaving Ohio State he enlisted in the Army as a second lieutenant.

In the spring of 1919, Mr. Forst's second son, A. D. Forst, Jr., became an employee.

In the fall of 1919, Mr. Forst offered to sell his interest or buy the Townsend stock. We sold our stock to Mr. Forst, as also did R. K. Bowman, on January 1, 1920.

Since 1920, the Robertson Art Tile Company has grown to be one of the leading companies in the country. Its officers at the present time are D. Parry Forst, President; Arthur D. Forst, Jr., Vice-President; Edward S. Lovett, Secretary; and T. R. Cheyney, Treasurer.

Mr. Cheyney came to the Robertson Art Tile Company as a young man in 1891, so he has now seen continuous service for fifty years—probably a record for the tile manufacturing industry.

The Robertson Art Tile Company also holds a record for being the only one of the first eighteen factories to be still operating under the management of descendants of the original stockholders and to have its stock still in the family possession.

A. D. Forst died in 1933 at the age of sixty-seven. W. J. J. Bowman died in 1930. His widow still holds his stock. R. K. Bowman lives a retired life in Spring Lake, New Jersey.

Grueby Faience and Tile Company, Boston, Massachusetts

William H. Grueby started his first factory in Boston, Massachusetts, in 1891.

"He was the pioneer in making faience tile. He started by making briquettes for fireplace linings. He introduced the first briquette fireplace linings and their use for facings and hearths." (7)

In 1907, he closed this factory. In 1909, he started a new company in Hartford, Connecticut, and called it the Hartford Faience Company. He again specialized in high-class faience tile. At one time he employed as many as one hundred persons. After closing his Hartford plant in 1913, Mr. Grueby was engaged by the C. Pardee Works (see p. 138) and they started to manufacture faience tile.

The Hartford factory is now being used for making electrical porcelain.

Providential Tile Company, Trenton, New Jersey

This Company was organized by Joseph L. Kirkham, James H. Robinson, and C. Lewis Whitehead.

"After a few prosperous years, Mr. Robinson and Mr. Whitehead bought out Mr. Kirkham and continued with the business together. Mr. Kirkham went to Barberton, Ohio, and started a factory in that city under the name of the Kirkham Art Tile Company (see p. 134).

"About 1900, Mr. Whitehead and Mr. Robinson dissolved partnership, Mr. Whitehead continuing alone.

"During these early years, the Providential Tile Company started a decorating department, being the first tile works in this country to decorate its product, such ware being imported from Europe. The venture succeeded and grew to large proportions, and many other similar enterprises in America followed the example of the local plant." (23)

This Company was able to make this class of tile because they employed an Englishman by the name of Mr. Callowhill, who was an artist and modeler. They also had Mr. Callowhill's two sons with them, Hubert and Ronald, both of whom were decorators.

From 1890 until after about 1910, beautiful relief designs, in white glaze decorated in gold, were very popular, as well as relief designs in highly decorated caps and borders.

In 1912, Mr. Whitehead died, and his wife, who before her marriage was the outstanding concert singer, Emma Thurston, endeavored to carry on the business. The Company only lasted about a year, when the factory was closed and never again used as a tile factory.

The Company never grew to be a very large one, as it confined itself to high-class ware—quality, not quantity. They did not make floor tile, and their greatest output was probably around 500,000 square feet.

Mrs. Whitehead died in 1915, and all the Callowhills have passed away.

Maywood Tile Company, Maywood, New Jersey

This factory was originally a foundry and machine shop. Then it was used to make a patented heating stove, which was composed of tile anchored in an iron frame. They did not make this tile, but purchased it outside. The factory was run by a Mr. Altrich and his son, Otto, and was financed by two New York businessmen, Mr. Jaegar and Ernest Bilhuber.

"About 1891, they decided to make their own tile. Mr. Altrich, Sr., got William E. Rivers of Old Bridge, New

Jersey, to give him a body and some glazes, and Mr. Rivers would come to Maywood week ends to instruct him. (Mr. Rivers later organized the Old Bridge Enameled Brick and Tile Company, see p. 136.)

"In the later part of 1891, they engaged Fred H. Wilde (who had been with the International Tile and Trim Company) as their Superintendent. They at once began to manufacture anchor-back tile for stoves and enameled glazes for hearths and mantels. Mr. Wilde stayed with them for a little over a year and a half.

"In the meantime, Mr. Jaegar, the principal backer, got tired of putting up money and Mr. Bilhuber, the other backer, took hold as Manager. He immediately rehired Mr. Wilde, who stayed with them until October 21, 1899, when he left to go with the Providential Tile Company, Trenton, New Jersey." (36)

After Mr. Wilde, Max Metzner was employed. (Mr. Metzner was formerly with the Hamilton Tile Company, Hamilton, Ohio, see p. 138.)

Mr. Wilde states: "In those days, formulas and recipes were the private property of the ceramist; they were, in fact, his capital. So when I left Maywood I did not leave my formulas with my successors." (36)

At this time, the Maywood Tile Company had four periodic kilns, one 9-foot, two 12-foot, and one 14-foot.

By 1905, this factory was closed down and was never again used as a tile factory.

Mr. Bilhuber has been dead many years.

Alhambra Tile Company, Newport, Kentucky

"Two brothers, Arthur and Otto Hatt, built a small tile factory some time before 1886, for it is recorded that they failed during this year. The name of the Company was Hatt and Hatt, and they made glazed tile.

"After this failure, the Hatt brothers interested Colonel R. W. Wilson, John Meyerberg, Otto Metzner, and John Sheehy in organizing a new company, the Kensington Tile Company, which made enamel glass tile. This Company failed in 1892." (30).

In 1901, a Company was organized headed by John F. Sheehy, and they took the name of the Alhambra Tile Company. This time they were successful in establishing a going business, and the factory has been in operation ever since. It is evident, however, that this Company has never expanded greatly, as today they have only four periodic kilns (one biscuit and three glost) and a rated capacity of 180,000 square feet annually.* They have confined themselves to manufacturing faience and glazed enameled wall tile.

John F. Sheehy, Sr., was President as late as 1936; his son, John F. Sheehy, Jr., is now President and Treasurer.

Kirkham Art Tile Company, Barberton, Ohio

This factory is listed (although it was only in existence a few years) because it was controlled by Joseph L. Kirkham, one of the men who was instrumental in starting the Providential Tile Company, Trenton, New Jersey (see p. 133).

"Joseph L. Kirkham left the Providential Tile Company and went to Barberton, Ohio, where he obtained capital interested in building a factory. This proved to be a flat failure, for the factory burned down. Mr. Kirkham collected some money from the owners, surrendered his interest, and left for California." (36)

Mr. Kirkham must have left Trenton a few years after the Providential Tile Company was started and arrived in Barberton about 1893. It is on record that the Kirkham Art Tile Company quit business in 1895. He then went to Tropico, California, and started another company (see Kirkham Tile and Pottery Company, p. 148).

Mosaic Tile Company, Zanesville, Ohio

"In the early nineties, there was laid out an addition to the city of Zanesville, which has since been known as Brighton. In the extreme southwest of this addition, the old Muskingum County Fair Grounds is located on the south side of Coopermill Road. Across the road from the Fair Grounds is a tract of land comprising approximately two city blocks. This land was low and rather swampy.

"A few local men with business foresight decided to erect a plant on this location for the manufacture of ceramic mosaic floor tile. In September, 1894, corporation papers were obtained in the name of the Mosaic Tile Company; stock was distributed under the leadership of Herman C. Mueller and Karl Langenbeck, both of whom had given up their positions with the American Encaustic Tiling Company. Associated with these men were David Lee, T. J. Frazier, J. K. Arnold, Thomas Forgerty, William E. Miller, William M. Bateman, and William M. Shinnick,

William M. Shinnick

* Ceramic Trade Directory, 1943.

the latter handling the financing of the business. David Lee was the first President of the Company.

"For three years, or until 1898, the Company's sole kiln capacity was one round kiln with a diameter of about ten feet. At the expiration of this time, three round kilns, each with a diameter of twenty feet, were added. These kilns are still in use in the present plant.

"At this time, a spur track was constructed from a branch of the Belt Line Railway Company, now known as the Zanesville Terminal Railroad Company, which served as a means of bringing in an occasional carload shipment of crude clay, for it must be remembered that little of the tile manufactured is made from local clays. Up to this particular time, the number of men employed had not reached an excess of forty.

"It would be only natural to expect that in the early days many problems of manufacture developed which were of serious consequence to the progress which the little Company was trying to make. Under today's display of products and great variety of items there is a sober history of effort, enterprise, and tenacity which reflects back to the early days and to the character of the men active at that time in the business.

"Many products were tried. Many ideas were offered and many insurmountable difficulties were among their problems.

"In the first organization were two superintendents, Herman C. Mueller and Karl Langenbeck.

"In that day, little clay-working machinery had been developed. Methods were followed which would be called exceedingly crude by today's standards.

"The early sales efforts were largely dominated by the efforts of Mr. Mueller and Mr. Langenbeck, who exchanged their places by being alternately in the plant and out on the road with the customers and with architectural contacts which had to be stimulated to offset the competition which substitutes for tile presented to the building and buyer of that day.

"The men associated with this enterprise were alert to growing demands, and as the use of tile became more popular in building construction, it was deemed advisable to make a limited quantity of 6-inch square and 6-inch hexagon floor tile, including some of the crenulated as well as tesselated patterns. The manufacture of this line, however, was discontinued after a time, as the demand for this kind of tile decreased.

"It was decided that further manufacture of the product would be confined to ceramic vitreous and semivitreous floor tile. These tile were to be made in about ten sizes, including 2-inch hexagons and $2^1/_8$-inch squares and were to include five or six different colors.

"During the early part of 1900, the business had grown so that it became necessary to have greater kiln capacity. It was during this year that the construction of six additional periodic kilns of more modern type was started. The expansion of business and the increase of manufacturing facilities made it necessary to remove the original offices. In fact, since that time the offices have been moved three times to make room for further building programs which were absolutely necessary to meet the growth of business.

"One of the most important developments at this time was the sequence of events which brought into more active participation in the business William M. Shinnick, then Secretary and Treasurer of the Company. H. C. Mueller and Karl Langenbeck had resigned from the business in 1903. Heavier responsibilities were thereafter thrown upon Mr. Shinnick. He almost immediately named J. M. Morton as Superintendent, and in 1901 N. E. Loomis became affiliated with the Company as Sales Representative.

"The fine quality of the product which this Company produced and their admirable methods of doing business soon necessitated the establishment of business centers outside Zanesville. In the latter part of 1902, a New York branch office and warehouse was established. This branch of the business was in charge of R. E. Jordan, Sr., who is now President of the Company. At a later date, warehouses were established at Los Angeles, San Francisco, and Chicago, and sales agencies were located in many other important cities throughout the United States.

"The management felt warranted in taking up the manufacture of a limited line of plain wall and trim tile for wainscoting purposes. To take care of this anticipated new business, the Company obtained a one-year lease on a small pottery plant in Putnam. In this new plant, the Company began to manufacture cap and base glazed tile in a few more popular shapes and colors. At the expiration of the lease in 1903, the business then being conducted at Putnam was transferred to the main plant in Brighton, and the Putnam plant was closed.

"The transfer of the business conducted at the Putnam plant made it imperative that additional land be secured, and a parcel of land directly east of the main plant, consisting of about three acres, was purchased. Three or four substantial buildings for the making of glazed tile were erected, and a number of new kilns were constructed. In addition to the new factory buildings, new office quarters were added. In subsequent years, still other buildings for manufacturing purposes were erected. As time passed and the business increased, other and more modern kilns were installed in the new factory. These kilns included six tunnel kilns which were operated continuously. The building activity and improvements in modern equipment took place in 1924, 1925, and 1926.

"During the formative period of this Company, William M. Shinnick, at that time General Manager, was on the job early and late. On many occasions he reached the plant as early as five-thirty and six o'clock in the morning, and it was his rule to remain as long as his presence was required. His untiring interest in the business often kept him until the late hours of the night, as he gave his personal attention to many details of manufacture. It was his custom to ride to the plant on one of the early morning streetcars, but later he could be seen driving to work in his horse and buggy.

"Mr. Shinnick was a man with plain, blunt, democratic manners and one whose word was as good as his note. To those with whom he was associated, he left a legacy, as did Caesar to the Romans in that far-flung day. That fine legacy was in the form of traits of fairness, dependability, and loyalty, and the memories of this grand old man are still cherished in the hearts of those who knew him.

"In 1923, Mr. Shinnick died, and from 1923 to 1928 William M. Bateman was the President of the Company. He died in 1928.

"From 1928 to 1936, Russell P. Herrold was President of

the Company and General Manager. R. E. Jordan was Vice-President; A. T. Falconer, Treasurer; and N. Straub, Secretary. In 1936, R. E. Jordan was elected President.

"From time to time, adjacent land was acquired until

Roy E. Jordan

the property now owned by the Company comprises approximately thirty acres. The buildings occupied by the Company at present may conservatively be estimated to have a manufacturing floor space of six acres. The Company during the peak of business has had on its payroll as many as twelve hundred and fifty employees.

"In 1902, the Mosaic Tile Company leased the plant of the Matawan Tile Company, Matawan, New Jersey, and operated it under the lease for two years. After that time, the plant was operated by the Matawan Tile Company, a new corporation having no connection whatever with the Mosaic Tile Company (see p. 140).

"In 1920, the Mosaic Tile Company purchased the plant and property of the Atlantic Tile Manufacturing Company, Matawan, New Jersey (see p. 143), which was owned and operated by Charles Barker, and at that time was a one round-kiln plant engaged in making only floor tile. They immediately increased their capacity, first building ten round kilns and later on tearing them down, and are now operating it entirely with tunnel kilns.

"In 1935, the Mosaic Tile Company purchased controlling interest in the Carlyle Tile Company, Ironton, Ohio, engaged in the manufacture of quarry tile and brick. They have operated it continuously as a quarry tile plant.

"In 1937, the Mosaic Tile Company became interested in the General Tile Corporation, El Segundo, California, and later acquired controlling interest (see p. 150).

"The Mosaic Tile Company ranks among the two largest tile manufacturers in the United States. Its product has been literally scattered to every civilized country in the world. Today it makes a complete and extensive line of tile and kindred products. No installation of floor or wall tile is too big for accomplishment. With its record of excellent installations goes a record of honest and fair dealing to its customers and to its employees. The name 'Mosaic' stands today for what is good in the way of fair dealing, conscientious effort, and quality of product throughout the tile industry." (9)

Old Bridge Enameled Brick and Tile Company, Old Bridge, New Jersey

W. E. Rivers came from England to Trenton, New Jersey, about 1885. At first he worked in a pottery in the Lamberton district, but later he secured a small one-kiln plant in the Millham section of the city and started to make tile in a small way.

Judge Disbrow of Spottswood, New Jersey, offered Mr. Rivers some land if he would move his plant to Old Bridge, New Jersey, and Doctor Van Ness offered to put up the necessary capital, so Mr. Rivers moved to Old Bridge about 1890 and built a small factory. Before long they had to have additional capital, so they obtained a loan from the People's Bank of New Brunswick, New Jersey.

William E. Rivers

Mr. Rivers did not succeed, however, so after a few years the bank had to take over the property.

"The name of this first Company was the Old Bridge Tile Company.

"About this time, a young man by the name of W. L. Strong was looking about for a chance to obtain a business of his own. Someone told him of Mr. Rivers and of the Old Bridge plant. Mr. Strong had no money of his own, but had a friend by the name of Hamilton Hazelhurst who offered to back him. Both of these gentlemen, I believe, came from Chicago.

"Mr. Strong made arrangements with the bank and with Mr. Rivers, and in 1893 the new Company was formed with the name of the Old Bridge Enameled Brick and Tile Company.

"Mr. Hazelhurst and Mr. Strong each had a third interest and Mr. Rivers was given a third interest for his experience. W. L. Strong was President; Hamilton Hazelhurst, Treasurer; and William E. Rivers, Superintendent.

"This setup proved to be a winner. Mr. Rivers produced about the finest line of enameled colors of his day and also a high-class vitreous white and colored floor tile. Mr. Hazelhurst knew how to handle the finances, and Mr. Strong got to be an outstanding salesman in the trade." (21)

Mr. Rivers invented what is known as the Rivers downdraft periodic kiln. Downdraft kilns were considered to be better than updraft kilns because they saved fuel, and this was an improvement on the Lawton and other types of downdraft kilns. Mr. Rivers was evidently the first to produce beautiful colored crystal glazes on tile.

Of course the Company prospered, and they were employing about two hundred persons when, in 1903, they entered into a consolidation with the Robertson Art Tile Company, Trenton, New Jersey, and the Columbia Encaustic Tile Company, Anderson, Indiana.

This new Company was called the National Tile Company (see p. 141).

The Old Bridge Enameled Brick and Tile Company only stayed in this consolidation one year, when they withdrew and took back their old name.

W. E. Rivers died July 17, 1917. Charles H. DeVoe, who had been Mr. Rivers' assistant, bought Mr. Rivers' one-third interest and became Superintendent.

In 1927, a new consolidation was organized under the name of the Robert Rossman Corporation (see p. 146).

The Old Bridge people sold out for cash to this Company, and that was the end of the Old Bridge Enameled Brick and Tile Company.

Mr. Hazelhurst retired to private life, his home being in Spottswood, New Jersey. He died about 1929.

W. L. Strong also retired to private life, his home being in New Brunswick, New Jersey. He died in 1938 at the age of seventy-six.

Charles H. DeVoe was engaged by the Rossmann Corporation to manage their Old Bridge Branch. He remained as Manager for one year (until January 1, 1929).

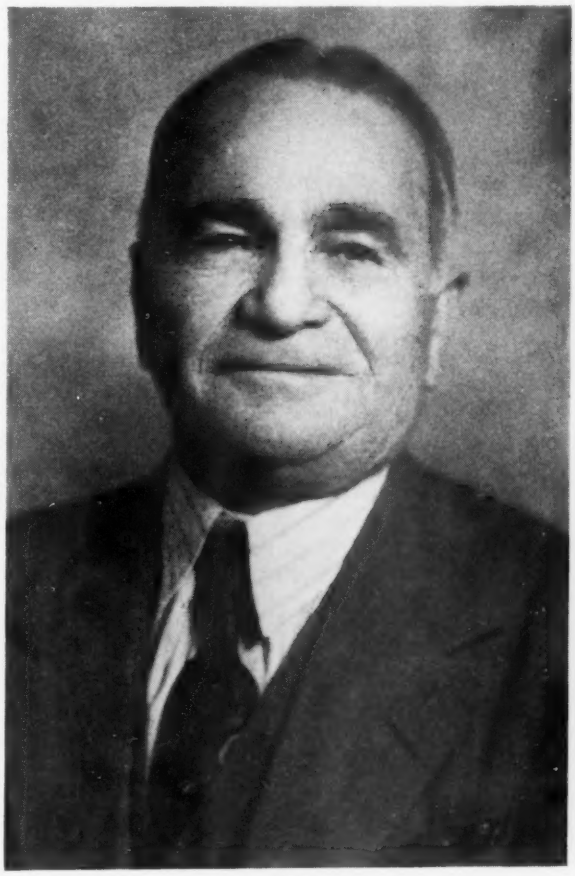
Mr. DeVoe for several years has been selling tile to the contractors. The name of his Company is the Old Bridge Tile Company, with his office and showroom at Old Bridge, New Jersey. He resides in Spottswood, which is only five miles from Old Bridge.

The Old Bridge plant is now owned by the Quigley Company (main office, New York City), which purchased the plant for a small sum and paid the back taxes. They manufacture high-temperature brick and cement.

Penn Tile Works Company
Aspers, Adams County, Pennsylvania

D. C. Asper relates: "My father started in the manufacture of encaustic tile in 1894 and was incorporated under the laws of Pennsylvania under the name of the Penn Tile Works. Owing to the unsatisfactory experience with his associates who were interested in the business, the corporation lasted but a few years, after which my father operated unincorporated until his death in December, 1912. Under his will my brother and I became possessors of the plant, and we incorporated under the name of the Penn Tile Works Company, Incorporated, and have been operating ever since. The encaustic tile, which were the large sizes, eventually went off the market and what is known as ceramic floor tile took their place and have been used extensively ever since.

"Of course, we have had our ups and downs during the depression years, as have all tile factories. We had our prosperous days up to 1929, when the break came. We had a hard struggle to remain in business during the depression years, but we weathered the storm and last year was the only year we in any way approached our capacity. Another severe drop in building construction followed, however, owing to the WPB ruling which curtails all building projects costing more than $500, except Government jobs and jobs having high priorities. We have been enjoying some of this business, and our future will depend largely upon what percentage we can get from now on.



D. C. Asper

"In addition to the manufacture of ceramic floor tile, we placed upon the market a few years ago a clay aggregate made from practically the same material as ceramic floor tile. It is shaped before being fired and then fired to the point of vitrification. This has been used for cast stonework and for areas such as floors of cafeterias, kitchens, and operating rooms where acid-resistant surfaces are required

(1943)

"At the same time, we placed upon the market a nonslip aggregate made from clay bodies with silicon carbide inserted in the raw body before shaping into aggregate and firing. This is used with marble chips in terrazzo floors to give the surface nonslip qualities. We have only one real competitor on this nonslip aggregate, and we believe we have the best aggregate upon the market. We were recently awarded a nice contract on this nonslip aggregate, to be used on the surface of the terrazzo floors in the War Office Building in Arlington, Virginia. This is evidence of its merits and will be quite an advertisement to us wherever Government work requires nonslip aggregate.

"I might also mention that we have access to extensive clay deposits on a 3200-acre tract that is owned by the same stockholders as the Penn Tile Works Company. On this tract we have a variety of clays, one of which fires naturally to a black.

"Our corporation is more or less closed. I own 75% of the stock and my brother owns 25%." (15)

C. Pardee Works, Perth Amboy, New Jersey

Calvin Pardee, for whom the Company was named, lived in Hazleton, Pennsylvania. The Pardee family owned many coal-mining properties in this anthracite district and was one of the largest companies mining anthracite coal in the United States.

I have been unable to ascertain how the Pardees came to get into the tile business, but I do know they operated a steel plant on the Raritan River at Perth Amboy, New Jersey. This is how their tile plant came to be located in this city. I feel sure they started about 1894.

The ground on which they built their factory was adjoining the steel mill and was at one time owned by a Free Love Society. On this property was a large three-story building which these people used as their domicile. The Pardees took over the property and used the three-story building as a nucleus for their tile factory and as an office. They had to build a kiln shed in which they installed several periodic kilns.

"In starting his factory, Mr. Pardee did not seem to have much success, but he was a very determined man and very wealthy, so he kept on. At one time, he had three ceramists, each one in a separate laboratory. Of course, this caused much confusion in the factory.

"Their best man was George Pyatt, who produced some new colors and soon showed them on the New York market.

"For some reason, however, the factory was closed down about 1898 and did not open again until a few years afterward." (36)

In 1900, they engaged Captain Metzner and his son, Max (who had come to Perth Amboy from Hamilton, Ohio (see Hamilton Tile Company, opposite column)), to superintend the plant, so they reopened the factory.

I visited this factory about 1901 and can remember distinctly the layout of the main building and kiln shed.

In 1908, the Metzners left the Pardees and with financial backing built a plant of their own (see Perth Amboy Tile Works, p. 142).

I have been unable to find out whom they had for their ceramist after the Metzners left.

About 1914, William H. Grueby came from Hartford, Connecticut, to join the Pardee staff. They then started to make the same faience line that Mr. Grueby had made at Hartford (see p. 133).

"In 1935, the officers were President, Charles F. Eilert; Vice-President and Treasurer, C. Pardee Foulke; and Secretary, Morgan B. Eilert.

"They had twenty periodic kilns (six biscuit and fourteen glost) and two tunnel kilns (one biscuit and one glost); the fuel used was producer gas.

"They made white wall tile and faience floor tile; bright white-glazed, satin-finish and colored wall tile; colored faience; and white and colored floor tile. The rated capacity of the plant was 6,000,000 square feet annually.

"They had a working agreement with the Matawan Tile Company, a selling organization known as the Pardee-Matawan Tile Company." (4)

In 1938, the officers were President, Ario Pardee; Vice-President and Treasurer, C. Pardee Foulke; Secretary, Morgan B. Eilert; and Superintendent, Charles W. Eilert.

This Company failed in 1938 and went into the hands of a receiver. It has never been reopened, and I believe it has been dismantled.

Ario Pardee is now living in Princeton, New Jersey. The Metzners have been dead a long time, and Mr. Grueby died about 1931.

Hamilton Tile Company, Hamilton, Ohio

I have been unable to obtain any information as to the exact date this Company was organized or who started it.

Captain Metzner and his son were active in the management. These gentlemen today would be called ceramic engineers. This Company had a very small plant, and the Metzners may have been the sole owners. The venture was unsuccessful, for they failed in 1896. They must have been able to obtain more capital, for they started up again, but failed in 1899.

The Metzners then left Hamilton and went to the C. Pardee Works in Perth Amboy.

After this failure, some Hamilton people organized a new company and called themselves the Ohio Tile Company. It failed in 1901. They reorganized and started up again under the same name, but with no better success, as they failed again in 1909.

This was the last attempt to establish a tile factory in Hamilton.

RETROSPECT

What has become of all of these pioneer factories and their personnel? Only four of these factories, the Alhambra Tile Company, the Mosaic Tile Company, the Penn Tile Works Company, and the Robertson Art Tile Company, are still being used as tile factories.

Three of these companies are still controlled by the families who originally owned the stock, namely, the Mosaic Tile Company, the Penn Tile Works Company, and the Robertson Art Tile Company.

The presidents of two companies are the sons of the first presidents: D. C. Asper of the Penn Tile Works Com-

pany and D. Parry Forst of the Robertson Art Tile Company.

Of the one hundred persons I have named, but eight are alive as of this date (1942), namely, Ario Pardee, W. H. Henry, Roy E. Jordan, George L. Esp, R. K. Bowman, T. R. Cheney, Everett Townsend, and F. H. Wilde.

All of these early factories obtained their recipes for bodies and glazes principally from Englishmen, who brought them over from England, namely, Samuel K eyes Mr. Plant, George W. Robertson, W. E. Rivers, J. L., Kirkham, Fred H. Wilde, and the Pyatt brothers.

Then there were Captain Adolph Metzner and his two sons, Max and Otto, who were presumably of German extraction.

It was not until after 1900 that we began to obtain ceramic engineers from the universities.

In 1896, the Ohio State University opened a ceramic course under the direction of Edward Orton, Jr., and other states followed from time to time, so that after 1900 these universities were graduating what are now called ceramic engineers, and the ceramic industry began to receive the technical help it so much needed. With the assistance of these college graduates, the products of the factories immediately began to improve.

No essential change had been made in the firing process for centuries, until about 1910, when the widespread installation of tunnel kilns occurred.

Tile Manufacturers Association

"This Association had its inception at a meeting at Cresson Springs, Pennsylvania, in 1893 and was called to discuss the tariff situation then confronting the industry. The organization was then formed and held its first meeting in October, 1893, at Pittsburgh, Pennsylvania." (6)

Francis W. Walker was electe Secretary. The Association has no record of which companies were the charter members or who the first President was, but I believe that the Star Encaustic Tiling Company, the United States Encaustic Tiling Company, the American Encaustic Tiling Company, the Beaver Falls Art Tile Company, the Columbia Encaustic Tile Company, the Cambridge Tile Manufacturing Company, the Robertson Art Tile Company, the Grueby Faience and Tile Company, and the Providential Tile Company were the original members. I think that Mr. Fischer of the American Encaustic Tiling Company was the first President. After his death in 1903, Emil Kohler was President. (In fact, Mr. Kohler may have been the first President.)

"For a number of years, the interest of the Association was in matters mainly relating to the tariff.

"Beginning with 1905, the activities of the Association broadened out materially. Many things were undertaken then that later proved beneficial, and in a large measure the Association pioneered much of the work now accepted as standard practice by other and more powerful associations. Matters of credit, protection, sales promotion, joint advertising, and apprentice training were each, inturn, undertaken collectively. In all, it was a service appreciated by those for whom it was directly intended, as well as by those among the trade whom it sought to serve." (6)

During the early years of the white wall-tile manufacture, companies making this line were vying with each other to see who could put on the market the handsomest line of caps, borders, and bases, made in many sizes, heavily embossed, and many with beautiful decorations.

These lines were costly to produce, so the Association appointed a committee of three to meet at Beaver Falls, Pennsylvania, to weed out as many designs as possible and establish standard patterns to which each factory could adhere. Members of the Committee were Francis W. Walker, Chairman, and Secretary of the Association; Harry D. Lillibridge, the American Encaustic Tiling Company; and Everett Townsend, the Robertson Art Tile Company.

Each factory sent a full line of samples to Beaver Falls, and we worked two weeks to straighten out this problem.

Mr. Walker resigned on December 17, 1927, to give his undivided attention to his new company, the Rossman Corporation (see p. 147).

"The office of the Association, which had been at Beaver Falls, then was moved to New York, and its present address is 50 East 42d Street, K. Maloney, Secretary." (8)

American Ceramic Society, Incorporated

"The American Ceramic Society was founded in 1898 and incorporated in 1899 under the direction of General Edward Orton, Jr. For nineteen years it functioned as an academic organization, publishing annual *Transactions* and holding Annual Meetings each spring." (32)

The first Meeting after the organization was held at Detroit, Michigan, in 1900. The second Meeting was held at Old Point Comfort, Virginia, in 1901, which Meeting I attended as a member.

Although this Society was not part of the tile industry, most of the prominent men of our industry became members. In those early Meetings, we always had a Section 'Q" where we would get together and talk over our problems.

Companies Organized Between 1900 and 1920

Between 1900 and 1920, there were quite a few new companies organized. About the only ones that made any headway during this era were those in the following list:

(26) New Jersey Tile Company, Trenton, New Jersey, 1900.
(27) Matawan Tile Company, Matawan, New Jersey, 1902.
(28) National Tile Company, Anderson, Indiana, 1903.
(29) Eagle Tile Company, Keyport, New Jersey, 1903.
(30) Empire Floor and Wall Tile Company, Zanesville, Ohio, 1905.
(31) Kenilworth Tile Company, Kenilworth, Ohio, 1907.
(32) Perth Amboy Tile Works, Perth Amboy, New Jersey, 1908.
(33) Mueller Mosaic Company, Trenton, New Jersey, 1908.
(34) Atlantic Tile Manufacturing Company, Matawan, New Jersey, 1910.
(35) Atlantic Tile and Faience Company, Maurer, New Jersey, 1910.
(36) Architectural Tiling Company, Incorporated, Keyport, New Jersey, 1911.

(37) New Brunswick Tile Company, New Brunswick, New Jersey, 1911.
(38) Olean Tile Company, Olean, New York, 1913.
(39) United States Quarry Tile Company, Canton, Ohio, 1913.
(40) Wheeling Tile Company, Wheeling, West Virginia, 1913.
(41) Wenczel Tile Company, Trenton, New Jersey, 1915.

New Jersey Tile Company, Trenton, New Jersey

James H. Robinson, who had been a part owner of the Providential Tile Company, left them in 1900, and with his son, James H., Jr., started the New Jersey Tile Company. They bought a property on Muirheid Avenue, built a small plant, and began to manufacture floor tile.

Next to this property was the Star Porcelain Company, a young and growing business. Mr. Robinson had only been operating his factory about three years when the Star Porcelain Company wanted to enlarge its plant and needed Mr. Robinson's land. They therefore made a good offer for this property and the Robinsons accepted it. Mr. Robinson immediately began to construct a small modern plant on Brunswick Avenue.

"During the time Mr. Robinson and his son were associated in business, they enjoyed the distinction of being the first to employ glazed vitreous tile, which was used extensively for Government purposes." (23)

James H. Robinson, Sr., died in 1910, two months after the death of his son. Mr. Robinson's widow and two daughters, Miss Jane and Miss Dorothy, continued to carry on the business.

About 1919, they sold an interest in the Company to Francis M. Walker, who had been a salesman for the Trent Tile Company.

Later, as the Robinsons and Mr. Walker could not agree on a business policy, Mr. Walker offered to buy their interest and carry on alone. The Robinsons accepted the offer and retired from the Company in 1925.

When Mr. Walker died in 1932, "the Company carried on under the supervision of J. R. Whitman, a brother-in-law of Mrs. Francis M. Walker." (22)

"Miss Jane Robinson continued with the Company until Mr. Walker's death and for two years after, at which time the business was discontinued." (23)

The officers during these last days were J. R. Whitman, President and Treasurer; Marshall L. Whitman, Vice-President; and Robert C. Hunt, Secretary.

The Company under this management got into financial difficulties and received several loans from the RFC, but by 1934 they could not meet their obligations and were compelled to close the factory and go out of business.

This factory was again put in operation, however, under the name of the Newtown Tile Company, who bought the property from the RFC (see p. 147). At the time this Company took over the factory, it had four periodic kilns and a rated capacity of 1,000,000 square feet annually.

Thus ended the existence of the New Jersey Tile Company.

Mrs. Robinson has been dead a number of years. The two daughters live together in the old homestead at 178 Brunswick Avenue.

Matawan Tile Company, Matawan, New Jersey

"Karl Mathiasen was born on the West Coast of Jutland, Denmark, in 1860, and came to the United States with his father in 1873. They settled at Perth Amboy, New Jersey.

"Mr. Mathiasen started work in a local cork factory and later worked in the pressing department of the old Perth Amboy Terra Cotta Company.

"The Eskesen brothers were also born on the West Coast of Jutland.

"The Danes being a sea-faring nation, the Eskesens' father in early boyhood went to sea and by many adventures gained a reputation of being a daring sailor. The name 'Eskesen' was therefore well known on the West Coast.

"In the late eighties, the Eskesen boys came to the United States and settled in Perth Amboy.

"Karl Mathiasen, a brother-in-law of the Eskesens, started a terra-cotta company in 1890, which was known as the New Jersey Terra Cotta Company. When the Eskesens located in Perth Amboy, they went to work in the terra-cotta plant." (3)

E. K. Eskesen states: "The Matawan Tile Company started making tile on a small scale in 1898 and stopped in 1900. It started again in 1902 as the Mosaic Tile Company, Zanesville, Ohio, who rented the plant from us for two years (see p. 136). Karl Langenbeck was in charge for approximately one year before he was taken sick and had to leave. I worked under Mr. Langenbeck's supervision and helped run the plant. In 1904, we took over the plant, operating it as a floor-tile plant, and called it the New Jersey Mosaic Company; the name was changed later to the Matawan Tile Company.

"The Matawan Tile Company was really organized by Karl Mathiasen and the Eskesen brothers in 1902. B. K. Eskesen was the only one of these gentlemen who took an active part in the Company. Karl Mathiasen was President until he died in 1920. Since then, B. K. Eskesen has been President, and I am still Treasurer. We are the only two living Eskesen brothers." (34)

In 1908, the Matawan Tile Company purchased a factory in Keyport, New Jersey, known as the Eagle Tile Company (see p. 142).

They operated this plant for about four years, with Karl Davison in charge, but in 1912 it was sold.

In 1921, Alfred Mathiasen, son of Karl Mathiasen, joined the Company and is now Secretary. The Matawan factory has always confined its output to ceramics and vitreous floor tile.

About 1930, they built a small factory adjoining the main plant and began to manufacture a line of artistic glazed tile, this tile to be used whenever a highly decorated tile was called for. They operate this new addition to their line under the name of the Progressive Art Tile Company, Incorporated. The equipment consists of one small tunnel kiln and two sample decorating kilns operated by electricity.

The Matawan Tile Company now has eleven periodic kilns fired with coal, and their rated capacity is about 2,000,000 square feet per year.

The Matawan Tile Company and the C. Pardee Works had a selling organization for several years, called the

Matawan-Pardee Tile Company, but when the Pardee Works failed in 1938, this arrangement came to an end.

National Tile Company, Anderson, Indiana

Several attempts were made between 1900 and 1903 to combine the largest tile companies into one company. These attempts did not succeed, principally because the promoters and bankers wanted too much of a "rake-off."

These failures prompted the Columbia Encaustic Tiling Company to try to form a smaller combination composed of themselves, the Old Bridge Enameled Brick and Tile Company, and the Robertson Art Tile Company (see pp. 131, 132, and 137).

In 1903, a meeting was held with officers from each company attending, and the proposal was reviewed as set forth by the Columbia people. Before the meeting adjourned, a consolidation was agreed to, and a committee was appointed to draw up the necessary papers. The name of the new company was to be the National Tile Company.

The Columbia Encaustic Tiling Company, being the largest, was to have 50% of the new stock, and the Old Bridge and the Robertson were to have 25% each.

The officers were B. O. Haugh, President; George Lilly, Vice-President; A. D. Forst, Treasurer; and W. L. Strong, Secretary and Sales Manager.

The Executive Committee consisted of B. O. Haugh, Chairman; George Lilly, A. D. Forst, and W. L. Strong.

The Columbia Branch Manager was Harry Haugh, the Robertson Branch Manager, Everett Townsend, and the Old Bridge Branch Manager, Hamilton Hazelhurst.

The Columbia Encaustic Tiling Company made colored glazes, white wall tile, and a full line of vitreous and encaustic floor tile.

The Robertson Art Tile Company made colored glazes and white wall tile only.

The Old Bridge Enameled Brick and Tile Company made ceramics and various kinds of floor tile and one of the best lines of colored glazed tile in the United States. William E. Rivers, who was Superintendent, was considered to be the outstanding man in his day in producing colored glazes. Although there was not much call for them in the tile industry, he produced some beautiful crystal glazes in many shades. The Old Bridge did not make white wall tile.

One reason the Columbia people were anxious for this consolidation was because they had no selling organization of their own. They had been marketing their output through the Robert Rossman Company of New York City (see p. 146). They knew that the Old Bridge and the Robertson had good selling organizations headed by W. L. Strong and A. D. Forst. They figured that by combining these selling organizations they could easily handle the entire output of the new Company and could break away from the Robert Rossman Company. The first move the new Company made after being organized was to locate their main office in the Broad Street National Bank Building in Trenton, New Jersey. Mr. Forst, the new Treasurer, and W. L. Strong, the Sales Manager, moved into these new offices.

The next move was to organize and consolidate a designing and estimating department, and it was decided to locate this department at the Robertson Branch. Herman Mueller was employed to organize and manage this department. Mr. Mueller brought with him from the Mosaic Tile Company two brothers, George and Jim Grigsby George Grigsby was put in charge of the designing room.

As ceramic tile were not made at the Robertson Art Tile Company, it at once became apparent that it would be a good policy to ship ceramic tile in bulk from Anderson to Morrisville and set up an assemblying and pasting department at this Branch. This would save some expense in shipping ceramics from Anderson to our eastern customers and facilitate filling their orders. Jim Grigsby was therefore made foreman of this department.

We started out with what seemed to be an ideal organization, and yet it did not prove to be a success for two reasons: (1) the overhead went up instead of down and (2) although at least two of the companies had been paying dividends before consolidation, the new company could not pay a dividend at the end of the first year.

One of the causes for the increased overhead was the renting of expensive offices in the Broad Street National Bank Building, in Trenton, New Jersey. A large showroom and warehouse were also opened in New York City at a high rental, and a new manager and a staff of assistants were employed. Then officials, who were hard workers in their own companies, now had to have assistants.

At the beginning of the second year, the Old Bridge people decided that they had had enough and would like to withdraw, take back their factory, and assume their old name, the Old Bridge Enameled Brick and Tile Company. I remember Mr. Hazelhurst saying, "I would rather be insky in the Old Bridge, than outsky in the National." As the Old Bridge was willing to pay a good price to withdraw, the deal was made and they ended their connection with the National Tile Company.

The National Tile Company continued another year and a half, when the Columbia people decided they would like the Robertson Art Tile Company to withdraw and take back their factory. The Columbia people made a very generous offer, the deal was settled, and the Robertson left the National Tile Company.

The Columbia people did not revert to their old name, but continued to do business as the National Tile Company, Anderson, Indiana.

After the Old Bridge withdrew, they retained the Trenton offices, but now that the Robertson was out, they at once closed these offices. They, however, retained the New York salesroom and warehouse.

After the final breakup of the consolidation, the new officers of the National Tile Company were B. O. Haugh, President; George Lilly, Vice-President and Treasurer; and Harry Haugh, Secretary. When B. O. Haugh died in 1912, George Lilly became President; Louis E. Lathrop, Vice-President; Harry Haugh, Secretary; and Louis S. Jones, Treasurer.

"George Lilly died in 1913. Mr. Lathrop then became President and James W. Lilly, Vice-President. The other officers remained the same.

"Harry Haugh died in 1923. Louis S. Jones then became Secretary as well as Treasurer.

"James W. Lilly died in 1924. Mr. Lathrop became

President; Louis S. Jones, Vice-President and Treasurer; and James A. Cranfell, Secretary. Mr. Lathrop died in 1934.

"The Company was sold in 1927, since which time it has been publicly owned, and it is not controlled by the families of the organizers." (10)

In 1938, the officers were Chairman of the Board of Directors, Charles B. Lansing; President and General Manager, C. G. Steinbicker; Secretary-Treasurer, John Sheridan; and Ceramic Engineer-in-Chief, Ralph E. Hanna.

"The present officers of the Company are as follows: Chairman of the Board of Directors, Charles B. Lansing; President and General Manager, C. G. Steinbicker; Secretary-Treasurer, R. M. Reydell; and Ceramic Engineer-in-Chief, J. S. Geiger. The rated capacity of the plant is 8,000,000 square feet annually." *

Eagle Tile Company, Keyport, New Jersey

This was a very small plant built in 1903 by Mr. Plant, the same Mr. Plant who was employed by the New York Vitrified Tile Company (International Tile and Trim Company) from 1888 to 1903 (see p. 130).

He operated this Keyport plant for only five years and then sold it to the Matawan Tile Company in 1908. He did not stay with this Company, and from all the information I have been able to obtain, he must have left the tile industry. He no doubt by this time has passed on.

The Matawan Tile Company operated this factory until 1912, when they sold it (see Architectural Tiling Company, Incorporated, p. 143).

Empire Floor and Wall Tile Company, Zanesville, Ohio

"J. B. Owens started in the pottery business in Roseville, Ohio, in 1888, moved his pottery to Zanesville, Ohio, in 1892, and operated under the name of the J. B. Owens Pottery Company. In 1905, he changed his pottery over to a tile plant and called it the Zanesville Tile Company. In 1906, he went into the hands of a receiver." (14)

He soon got his factory back again and began operating it. When he first started making tile in 1905, he always had his prices considerably below the Tile Manufacturers Association's prices; when he started up again, he still followed this practice, which caused a lot of "headaches" in the industry. In 1908, we tried to get him to join our Association, but without success. The Association then held a meeting to discuss how this problem could be handled. It was decided to form a syndicate, backed by most of the members of the Association, and have this syndicate make Mr. Owens an offer to buy him out, and he retire from the tile business. This plan was agreed to by Mr. Owens, and his plant was taken over and closed down.

While this deal was under way, Mr. Owens obtained an option on a pottery just across from his plant and began stocking it with saggers and other material so that with the least possible delay he could again start a tile factory. To everyone's surprise, in about one year he began making tile again, and this time he took the name of the J. B. Owens Floor and Wall Tile Company. How he was able to do this, I cannot remember.

In 1910, Mr. Owens again decided to change the name of his Company, and this time he called it the Empire Floor and Wall Tile Company. Soon after making this change in the name of his Company, he joined the Tile Manufacturers Association. I cannot remember if he thereafter adhered strictly to the Association's prices, but he evidently did as well as some of the other members.

In addition to his Zanesville factory, Mr. Owens built a new factory in Metuchen, New Jersey, in 1915. Here he installed a tunnel kiln which he claimed was his own design.

About 1920, he made another addition to his holdings by starting a tile factory in Greensburg, Pennsylvania, which he called the Domex Floor and Wall Tile Company. This Company went into the hands of the receiver about 1927.

"The Franklin Tile Company took over this property in 1928.

"The Schweiker brothers, Malcolm and Roy, who later organized the Franklin Tile Company (see p. 146) were associated with Mr. Owens in the Empire Floor and Wall Tile Company, both at the Zanesville and Metuchen factories. Previous to getting into the tile business, I (Roy E. Jordan) have heard them state that they were building ships at Hog Island during World War I.

"During World War I, the Empire leased the Metuchen plant to the United States Government.

"Mr. Owens again failed in 1929, and both the Zanesville and Metuchen factories were closed down and were never again used as tile factories.

"J. B. Owens died in poverty in 1934 and is buried in Homestead, Florida." (9)

Kenilworth Tile Company, Kenilworth, Ohio

This Company was started in 1907 by Richard L. Cawood of the Patterson Foundry and Machine Company of East Liverpool, Ohio, "to manufacture very special art tile." (24)

A new modern plant was built and a gas-fired tunnel kiln was installed. The officers of the new Company were R. L. Cawood, President; S. C. Williams, Vice-President; and J. A. May, Treasurer and Manager.

In 1909, Mr. Cawood disposed of his interest to Claude Nease, who became President, Treasurer, and Manager. Soon after Mr. Cawood left, they turned the plant over to the manufacture of standard floor and wall tile. From November, 1929, to June 1, 1930, Charles H. DeVoe, formerly with the Old Bridge Enameled Brick and Tile Company, was Superintendent.

In the summer of 1930, the Company went out of business, and the plant was closed down. Later it was sold. It is now owned by the New Castle Refractories Company.

Perth Amboy Tile Works, Perth Amboy, New Jersey

Captain Adolph Metzner and his son, Max, left the C. Pardee Works in 1908 and started a company in Perth Amboy called the M. A. Metzner Manufacturing Company. Thomas Atherly and I. C. Ostergaard were associated with them.

* Ceramic Trade Directory, 1943.

In 1910, August Staudt gained control of the Metzner Company when the Metzners left to become associated with the Architectural Tiling Company, Incorporated, Keyport, New Jersey (see opposite column). Mr. Staudt immediately changed the name of the Company to the Perth Amboy Tile Works.

In 1927, Mr. Staudt joined a consolidation called the Rossman Corporation (see p. 146). He took stock in the Rossman Corporation in payment for his factory and became one of the officers of the new Company, which lasted until 1930.

The Perth Amboy plant then lay idle for several years, when it was taken over by the City for taxes.

About two years ago, Mr. Staudt rented this factory from the City, with the idea of operating it again.

I visited Perth Amboy in May, 1942, and had a talk with Mr. Staudt. He told me that he was confronted with the closing of the plant, as the tile business was on the "blink" and practically all his help had gone into defense plants which paid exorbitant wages that he could not afford to pay.

The Perth Amboy plant was a well-constructed plant of brick and steel construction with two tall stacks about fifty feet high and eight periodic kilns. The kilns were arranged so that four of them were attached to each stack.

This factory made only floor tile, and it had a rated capacity of between 3,000,000 and 4,000,000 square feet per year.

Mueller Mosaic Company, Trenton, New Jersey

Herman Mueller left the Robertson Art Tile Company in 1908 (see p. 133) and organized the Mueller Mosaic Company. He took with him from the Robertson George and James Grigsby, as well as his son, William. His financial backer was Mr. Fisher, who operated the largest retail shoe store in Trenton.

They bought a small one-kiln pottery and started to make handmade Flemish and faience tile for floors and walls. Owing to Herman Mueller's artistic ability, they made some of the most beautiful tile ever produced in this country.

"They now have five periodic kilns (three biscuit and two glost) fired with coal and a rated capacity of 500,000 square feet annually."*

The Grigsby brothers died about fifteen years ago. Herman Mueller died September 21, 1941, at the age of eighty-five. William E. Mueller is now in charge of this Company as President and General Manager.

Atlantic Tile Manufacturing Company, Matawan, New Jersey

This Company was started in 1910 by Charles Barker and Mr. Gittens. It was only a one-kiln plant.

"In 1920, the Mosaic Tile Company purchased the plant and property of this Company (see p. 136). At that time they were making only floor tile.

"The Mosaic immediately increased the capacity, first building ten round kilns and later tearing these down and are now operating it entirely with tunnel kilns." (9)

This factory is now being operated by the Mosaic Tile Company under the name of the Atlantic Tile Manufacturing Company.

Atlantic Tile and Faience Company, Maurer, New Jersey

Roy E. Jordan states: "As nearly as I can find out, this factory was built and started by Anthony W. Christiana in 1910. 'Van.' Christiana, his brother, was made Superintendent." (9)

A. W. Christiana had been a salesman for the American Encaustic Tiling Company. In 1912, Mr. Christiana sold this factory to the American Encaustic Tiling Company, and it became the eastern branch of this Company.

About 1937, the American Encaustic Tiling Company was liquidated (see p. 128).

Malcolm A. Schweiker, who had been the liquidator of this Company, with several others, purchased the Maurer plant and formed a new company, which they named the American Encaustic Tiling Company, Incorporated.

American Encaustic Tiling Company, Incorporated

"The officers of this Company are Malcolm A. Schweiker, President and General Manager; Albert P. Braid, Vice-President and Plant Manager; H. B. Birtwistle, Treasurer; and Maurice Iserman, Secretary."*

Architectural Tiling Company, Incorporated, Keyport, New Jersey

After selling the Atlantic Tile and Faience Company to the American Encaustic Tiling Company, A. W. Christiana succeeded in obtaining some bankers to back him, and he bought a small tile plant in Keyport, New Jersey, known as the Eagle Tile Company, which was owned and operated by the Matawan Tile Company (see pp. 140 and 142).

Associated with Mr. Christiana at this time in starting the Company was Captain Metzner and his son, Max, who had left the Company they had founded in Perth Amboy (M. A. Metzner Manufacturing Company, p. 142). He called his new Company the Architectural Tiling Company, Incorporated.

This venture proved to be a failure, and the bankers had the plant on their hands. Later, they succeeded in selling to some persons who retained the same name and who are now operating it.

"The officers of this Company are President, S. M. Schatzkin; Vice-President, William Schatzkin; Factory Manager, R. V. Tailby; and Ceramic Engineers, K. F. Greene and R. M. Murphy.

"The capacity of the Company is 5,000,000 square feet annually. They have five periodic kilns (biscuit) and four tunnel kilns (glost). They make white and colored wall tile, as well as faience tile."*

A. W. Christiana, after this venture failed, was employed by the C. Pardee Works. He died about 1932.

New Brunswick Tile Company, New Brunswick, New Jersey

This Company, started in 1911 with Trenton, New Jersey, capital, made floor tile only. It was only a small one-kiln plant, and the Superintendent was an Englishman by the name of Frank Pyatt.

* Ceramic Trade Directory, 1943.

Gordon D. Phillips

Davis A. Cable

This Company is mentioned because of Mr. Pyatt's connection with it.

"In regard to the Pyatts, there were two of them, George and Frank—just as different as they could be. George drank to excess, but was the better ceramist, and Frank was very religious. Frank at one time was with the Matawan Tile Company and with the American Enameled Brick Company, South River, New Jersey.

"George was with the Empire Floor and Wall Tile Company in Zanesville. He left this Company and went with the Old Bridge. Later, he left the Old Bridge Company when the Empire built their new factory at Metuchen in 1915." (21)

The Pyatts were outstanding ceramists when I went with the Robertson Art Tile Company in 1895 and probably did their part in helping some of these early companies get started in the tile industry.

The New Brunswick Tile Company closed down in 1914.

Olean Tile Company, Olean, New York

"The Olean Tile Company was incorporated in 1913. The incorporators were O. W. Pierce, Charles T. Fuller, and Gordon D. Phillips. Mr. Pierce and Mr. Fuller are both deceased, but Mr. Phillips is active in the business and has been President of the Company for the past eighteen years." (11)

"The officers of the Company are Gordon D. Phillips, President; Norris E. Phillips, Vice-President and General Manager; M. Milton Groves, Secretary; Marvin H. Pond, Ceramic Engineer; and E. M. Tupper, Superintendent."*

This Company makes only floor tile, and their product has no superior.

They have seven periodic kilns and one tunnel kiln and their fuel is gas. They sell their output through a selling organization called American-Franklin-Olean Tiles, Incorporated (see p. 146).

United States Quarry Tile Company, Canton, Ohio†

This Company was originated in 1913 by its present management through the consolidation of two factories manufacturing roofing tile, one located at East Sparta, Ohio, and one at Parkersburg, West Virginia.

The manufacture of quarry tile was begun at once, thereby largely satisfying the demand for a product formerly imported.

The manufacture of glazed wall tile was started in 1929 and developed rapidly to a very large volume of excellent quality in a wide variety of colors.

One of the many products of this Company is a tunnel tile of exceptional merit used, among other places, in most of the vehicular tunnels in New York City, Washington, D. C., and Mobile, Alabama.

The present officers are D. A. Cable, President and General Manager; H. G. Beam, Vice-President; and W. G. Grogan, Secretary-Treasurer.

---

* Ceramic Trade Directory, 1943.
† Information supplied by D. A. Cable.

Wheeling Tile Company, Wheeling, West Virginia

The Wheeling Tile Company was organized by Samuel O. Laughlin and several other businessmen of that city in 1913. They purchased one of the old Wheeling Pottery Company's plants on the corner of Chapline and 32d Streets. This plant had five periodic kilns, and in later years they added five more.

Their output was strictly floor tile. In 1916, they purchased another plant formerly owned by the Wheeling Pottery Company, which was only one block away from the first plant on the corner of La Belle and 32d Streets. This factory had eight periodic kilns. At this time, Christian Friderichsen was their Superintendent. They decided to add electrical porcelain to their line, and this was the reason for purchasing this second factory.

Mr. Friderichsen decided to leave the Wheeling Tile Company during the summer of 1919, as he was going to start a tile factory of his own in Independence, Missouri, so they had to obtain a new Superintendent. Phaon H. Swalm of Trenton, New Jersey, was engaged. He had been with the Trenton Fire Clay and Porcelain Company for several years and, when he left Trenton, was teaching ceramics at the Trenton College of Industrial Arts.

By 1924, the Wheeling Tile Company decided to give up the manufacture of electrical porcelain and make white wall tile and colored glazes. This proved to be a good move, for under Mr. Swalm's management it was not long before they were using all of their eight kilns and had to enlarge their buildings and build a large tunnel kiln.

In 1929, S. O. Laughlin died and his son, Samuel O. Laughlin, Jr., became President.

In 1935, P. H. Swalm accepted an offer from the Frontenac Floor & Wall Tile Company, Limited, Kingston, Ontario, Canada, to take over the management of that Company, and on July 1, 1935, he left the Wheeling company.

The Wheeling Tile Company now has twenty-two periodic kilns and two tunnel kilns fired with gas. The rated capacity of the plant is 5,000,000 square feet per year.

"The officers are S. O. Laughlin, Jr., President; P. A. Laughlin, Vice-President; J. B. Youngson, Secretary and Treasurer; and R. W. MacDonald, Superintendent."*

Wenczel Tile Company, Trenton, New Jersey

I have been unable to get any information as to who organized this Company or the year it started. I remember going through this plant before leaving Trenton in 1920, so I think a good guess is 1915.

"In 1935, they had two periodic kilns, one experimental muffle kiln (biscuit), and made floor and wall tile. Rated capacity 1,500,000 square feet annually. President and General Manager, Stephen Wenczel; Superintendent, Alexander Kopczynsky." (4)

"They now have three tunnel kilns and nine periodic kilns fired with coal and oil. The rated capacity is 3,500,000 square feet annually. President, Stephen Wenczel; Vice-President, Chester Wenczel; Secretary, William Waldorf; Superintendent, Kenneth J. Bray."*

* Ceramic Trade Directory, 1943.

In 1940, the Wenczel Tile Company bought the Trent Tile Company property from the Reconstruction Finance Corporation (see p. 130) and are now operating the plant under their name. They have moved their office to the Trenton factory and have rented their New York Avenue plant to the Government for war purposes.

Companies Organized After 1920

Of the more than twenty-five factories organized after 1920, I am recording seven located in the Eastern states and a few located in California:

(42) Crescent Tile Company, Incorporated, Trenton, New Jersey, 1923.
(43) F. K. Pence Tile Works, Paducah, Kentucky, 1923.
(44) Standard Tile Company, Zanesville, Ohio, 1923.
(45) Franklin Tile Company, Lansdale, Pennsylvania, 1923.
(46) Rossman Corporation, Beaver Falls, Pennsylvania, 1927.
(47) Newtown Tile Company, Trenton, New Jersey, 1934.
(48) Superior Ceramic Corporation, Anderson, Indiana, 1935.

Crescent Tile Company, Incorporated, Trenton, New Jersey

August Reikosky (founder of this Company) started to work for the New Jersey Tile Company as a presser in 1906 and continued with this Company until 1919, when he was made Manager. He continued as Manager until 1923, when he left and, with four other persons, organized the Crescent Tile Company.

In 1934, Mr. Reikosky sold his interest and, with his two sons, started the Newtown Tile Company (see p. 147).

The Crescent Tile Company now consists of four periodic kilns (biscuit) and has a rated capacity of 2,000,000 square feet of floor tile annually.

C. H. Darling is President and General Manager.

F. K. Pence Tile Works, Paducah, Kentucky

F. K. Pence stayed with the American Encaustic Tiling Company, Zanesville, Ohio, for fourteen years. He left them in 1923 and "started this Company, of which he became sole owner. He operated this plant until 1940, when he sold the factory to Texas interests, who moved the equipment to San Antonio, Texas." (29)

At the time Mr. Pence sold his factory, the Company was making floor, wall, and decorative tile. They had six periodic kilns (two biscuit and four glost). The rated capacity of the plant was 1,500,000 square feet annually.

"Since July, 1940, Mr. Pence has been Associate Director for Ceramics with the University of Texas, Austin, Texas." (29)

Standard Tile Company, Zanesville, Ohio

This Company was organized in 1923 through the efforts of John M. Morton, who for many years had been Superintendent of the Mosaic Tile Company, Zanesville, Ohio. He had the backing of several Zanesville businessmen.

During the depression years of 1930 to 1934, the Company was operated on a very small scale. The worries of this period broke down the health of Mr. Morton, and he died about 1935.

They now have twelve periodic kilns for biscuit ware, and three tunnel kilns for glost ware. Gas is used for fuel. The rated capacity of the plant is 5,000,000 square feet of floor and wall tile annually.

"The officers at present are Ernest V. Gorsuch, President and Treasurer; Henry W. Orth, General Manager (succeeding William L. McCoy); and H. Zane Schofield, Plant Superintendent."*

Franklin Tile Company, Lansdale, Pennsylvania

The forerunner of this tile company was the Franklin Pottery Company, organized by Malcolm A. and Roy W. Schweiker. "Previous to getting into the pottery line, they had worked for the National Government at the Hog Island Shipbuilding yards, at Chester, Pennsylvania.

"They were afterward associated with the Empire Floor and Wall Tile Company at the Zanesville, Ohio, factory and at the Metuchen plant (see p. 142).

"The Schweikers got their tile experience working for J. B. Owens.

"Their pottery was organized in 1923, at which time they began manufacturing lighting fixtures; in 1926, they began to make tile.

"In 1927, they changed the name of their Company to the Franklin Tile Company, and at about the same time they absorbed the Domex Floor and Wall Tile Company, of Greenburg, Pennsylvania." (9)

The Domex Company was owned by J. B. Owens before it had been put into the hands of a receiver, and I have been informed that the Schweikers managed this Company for Mr. Owens. After 1927, the Franklin Tile Company enlarged their Lansdale factory and now have one of the largest and most up-to-date plants in the country.

The plant has three tunnel kilns and three periodic kilns which are fired with gas. The capacity of the Lansdale factory is 6,500,000 square feet annually. They manufacture white and colored wall tile, faience and floor tile, and bathroom fixtures.

The officers are Roy W. Schweiker, President, and George W. Thorp, Jr., Treasurer.

American-Franklin-Olean Tiles, Incorporated

"This is a jointly owned sales company which handles the products of the American Encaustic Tiling Company, Incorporated, Maurer, New Jersey; the Franklin Tile Company, Lansdale, Pennsylvania; and the Olean Tile Company, Olean, New York. M. A. Illing is Sales Manager." (20)

Robert Rossman, New York, N. Y., Importer of Tile

Herman Petri relates: "Robert Rossman was a young man in New York who worked for his father, Adolph Rossman, who was in the importing business in a small way on Broadway, just north of Canal Street. In 1893, he sent Robert to Europe, and on his return he brought back some samples of French wall tile and showed them to me in Conovers. The samples looked good to me, and the price was less than Scotch tile (Brown and Company), so I asked Mr. Rossman to have the factory send me two or three casks of tile so I could see what they looked like in mass, as I was skeptical ordering from samples. I gave Mr. Rossman an order, and this is what started him in the tile importing business. Of course, he later imported tile from different European countries, but I do not think he ever imported any German tile." (7)

"Robert Rossman carried on the business by himself from 1894 to January 1, 1908. George L. Esp went with Mr. Rossman in 1894 and in 1895 became General Manager.

Robert Rossman Company, New York, N. Y., Importer of Tile

"In 1907, Robert Rossman filed a notice of organization, to become effective January 1, 1908, as the Robert Rossman Company. The officers were Robert Rossman, President; Adolph Rossman (father), Vice-President; and George L. Esp, Secretary-Treasurer and General Manager." (26)

On May 13, 1908, Robert Rossman died suddenly.

"In 1911, the Chase National Bank, with a view of clearing up the estate of Robert Rossman, made an arrangement with the Beaver Falls Art Tile Company (see p. 131) to take over the Company.

Robert Rossman Company, New York, N. Y., Selling Organization for the Beaver Falls Art Tile Company

"This new setup continued to use the name of Robert Rossman Company, with F. W. Walker, Sr., President; James M. May, Vice-President; and George L. Esp, Treasurer and General Manager.

"From the time this Company was formed it became the selling organization of the Beaver Falls Art Tile Company.

"Business was carried on successfully until 1926. In this year, Francis W. Walker, Jr., started a movement for taking over several plants to form a new organization.

Robert Rossman Corporation, Beaver Falls, Pennsylvania

"In 1927, the Robert Rossman Corporation was formed. To finance this new Corporation, they borrowed $2,000,000 from the Banking House of the Dillon-Read Company." (26)

This new Corporation included the Robert Rossman Company, New York, N. Y.; the Beaver Falls Art Tile Company, Beaver Falls, Pennsylvania; the Old Bridge Enameled Brick and Tile Company, Old Bridge, New Jersey; and the Perth Amboy Tile Works, Perth Amboy, New Jersey.

The Old Bridge Enameled Brick and Tile Company sold out for cash, and Mr. Hazelhurst and Mr. Strong retired to private life. Mr. Hazelhurst died in 1929 and Mr. Strong in 1938.

Charles H. DeVoe, the other owner, states: "According to an agreement, I had to remain with the new Company one year. I remained as Manager of the Old Bridge Branch until January 1, 1929." (21)

* Ceramic Trade Directory, 1943.

August Staudt, the owner of the Perth Amboy Tile Works, took stock in the new Corporation in full payment for his Company. William Chell, who had been an officer of the defunct Brooklyn Vitrified Tile Works (see p. 130), was made Manager of the Perth Amboy factory.

The officers were F. W. Walker, Sr., Chairman of the Board; August Staudt, Vice-President; F. W. Walker, Jr., President; James M. May, Vice-President; William Waldorf, Secretary; and George L. Esp, Sales Manager.

Before this Corporation was formed, the Rossman Company had started the construction of an office building in New York City. "This construction was continued under the name of a holding company, as the bankers would not accept it as part of the deal because it had not been completed. I do not know if this building was ever completed." (21)

F. W. Walker, Sr., resigned as Secretary of the Tile Manufacturers Association in 1927 and "accepted the Chairmanship of the new Corporation, to which he gave much of his time, until 1931, when operations were discontinued, owing to improper and inadequate investment and banking direction and support." (6)

"At the end of 1930, the Rossman Corporation entered a petition in bankruptcy, and the Dillon-Read Company stepped in to liquidate the Corporation.

"Dillon-Read formed a holding company to liquidate the stock of the three factories." (25)

At the Beaver Falls factory, all machinery and equipment was sold and the buildings were disposed of.

The Old Bridge factory was sold to the Quigley Company, Incorporated, New York, N. Y., and is now being used to manufacture refractories.

The Perth Amboy factory lay idle for many years, and then the City of Perth Amboy took the property over for taxes. In 1941, August Staudt, the original owner, rented it from the City and is now endeavoring to operate it again.

Thus ended the second attempt to consolidate several tile factories.

F. W. Walker, Sr., J. M. May, Adolph Rossman, and William Chell are dead; William Waldorf is with the Wenczel Tile Company, Trenton, New Jersey; George L. Esp is retired; and F. W. Walker, Jr., is no longer connected with the industry.

Newtown Tile Company, Trenton, New Jersey

August Reikosky was one of the founders of the Crescent Tile Company (see p. 145). He left this Company early in 1934 and, with his two sons, Walter R. and Robert A., as assistants, started a small plant in Newtown, Pennsylvania, and called it the Newtown Tile Company.

"In 1936, they purchased the old Healey-Bedson Pottery, a two-kiln plant in South Trenton, and kept this plant in operation until April 1, 1942. The sharp curtailment of business was the cause of closing down this factory at this time.

"In 1939, they purchased the plant known as the New Jersey Tile Company from the Reconstruction Finance Corporation. This plant had been lying idle for a couple of years.

"From 1939 until 1942, they had three plants in operation; one at Newtown, Pennsylvania, one on Fairfacts Avenue, Trenton, and the old New Jersey Tile Company plant on Brunswick Avenue. At this latter plant they now have their main office." (22)

The capacity of this Company is as follows: Newtown factory, two periodic kilns and 400,000 square feet rated capacity; New Jersey factory, four periodic kilns and 1,500,000 square feet rated capacity; and Fairfacts Street factory, two periodic kilns and 600,000 square feet rated capacity, a total output of 2,500,000 square feet of floor tile annually.

"In April, 1942, the Fairfacts Street factory was closed down." (22)

Superior Ceramic Corporation, Anderson, Indiana

Louis S. Jones, who had been with the National Tile Company, left them in the fall of 1935 to form a company of his own.

"The officers of this new company were as follows: Louis S. Jones, President; H. F. Jones, Vice-President; and R. H. Louden, Secretary." (10)

They installed two Allied Engineering Company tunnel kilns, fired with gas. Their output consisted solely of white and colored glazed tile; they used a one-fire process.

"The Corporation discontinued operations early in 1940 and was dissolved in the latter part of 1941." (10)

The plant has since been dismantled. The Frontenac Floor & Wall Tile Company, Kingston, Ontario, Canada, purchased and dismantled the two kilns and moved them to Canada (see p. 150 for history of Frontenac Floor & Wall Tile Company).

Failures since 1920

"One fact which becomes immediately apparent is the large number of failures which occurred during the last decade.

"The building boom which developed shortly after World War I greatly expedited the establishment of new floor- and wall-tile plants; the Bureau of the Census reported 55 in 1925, 62 in 1927, and 75 in 1929. Production in 1929 by the 75 plants producing floor or wall tile (or both) as major products was valued at $28,300,000 and constituted 95% of the total United States output. Fewer than 30 of these plants, all east of the Mississippi River and north of the Mason and Dixon Line, accounted for about four-fifths of the 1929 output.

"With the decline in building construction in the United States between 1929 and 1934 and the consequent lessened demand for floor and wall tile, many domestic plants discontinued operations and some were dismantled.

"In 1935 and 1937, the number of establishments reporting to the Bureau of the Census was 46 and 52, respectively; other establishments making tile as products of secondary or minor importance accounted for less than 5% of the total United States production in those years." (1)

Price

"Tile commanded its highest price in 1925; the lowest price was reached in 1935. White glazed wall tile comprised a large percentage of all tile business. In 1925, tile sold for 35 cents per square foot; in 1935, it was sometimes sold as low as 15 cents. Colored tile dropped from 55 to from 20 to 25 cents a square foot." (31)

California

The tile industry in California did not make much headway until after World War I. All of the industry was located in the southern part of the State. It was centered mostly in Los Angeles and nearby towns, namely, Tropico, Vernon, Glendale, Alhambra, Berkeley, Hermosa Beach, Pomona, and El Segundo.

The following companies will give a picture of when the industry started and the pioneer companies which were responsible for its development.

The first four companies used the same factory; the first was succeeded by the next three.

Kirkham Tile and Pottery Company, Tropico, 1898.
Pacific Art Tile Company, Tropico, 1902.
Western Art Tile Company, Tropico, 1905.
Tropico Tile Company, Tropico, 1910.
Wade Encaustic Tile Company, Vernon, 1912.
West Coast Tile Company, Vernon, 1914 (the West Coast succeeding the Wade).
Pomona Tile Manufacturing Company, Pomona, 1923.
Proutyline Products Company, Hermosa Beach, 1924.
The American Encaustic Tiling Company took over the West Coast Tile Company in 1919 and the Proutyline Products Company in 1925.
The Gladding, McBean & Company did not get into the tile industry until they purchased the West Coast Tile Company from the American Encaustic Tiling Company in August, 1933.
General Tile Corporation, El Segundo, 1934.

There are, besides these factories, about ten small factories making mostly art and decorated tile, all of which have sprung up since 1920.

Kirkham Tile and Pottery Company, Tropico

"This Company was organized by Joseph Kirkham, who came to Tropico from Barberton, Ohio. Mr. Kirkham was always a plausible talker with a great imagination and came to Tropico, then a sleepy village nine miles from Los Angeles, in 1898, and induced some of the people there to contribute toward building a tile factory. He found one or two capitalists in Los Angeles to provide cash. A Mr. Richardson gave ten acres as a site. A Mr. Chanler, a retired builder from Chicago, erected the brick buildings. One rancher contributed $20,000. Mr. Kirkham never could make tile commercially and of course failed." (36)

"This Company failed in 1900." (4)

Fred H. Wilde further states: "After this failure, the factory was started again by L. Linsay, a rich miner, and E. M. Durant, a fine businessman, who bought the Tropico plant from the sheriff for 'a song' and paid the other creditors ten cents on the dollar. They engaged an electrical porcelain man from Ohio and started to make ceramic mosaics. He could not vitrify their body, so they let him go and hired Mr. Kirkham. He again failed to produce satisfactory ware, so they let him go and obtained another electrical porcelain man from Trenton, New Jersey. This man was there when I was employed and was still experimenting. By this time, they had changed the name of the company to the Pacific Art Tile Company." (36)

Pacific Art Tile Company

Fred H. Wilde was made Superintendent of this Company.

"Some time after I (F. H. Wilde) came with this Company, they again changed its name, and now called it the Western Art Tile Company.

Western Art Tile Company

"Unfortunately, these men from Ohio and Trenton had a body made for insulators, stilts, etc., and needed cone 10 or 11 to vitrify their ware, and as the only clay they had for saggers was a low-grade fire clay, the sagger cost was ruinous. Twenty-five per cent of their kiln space was taken up by empty saggers.

"I had to rebuild the inside of the factory by degrees. They had a forty-leaf wooden press and two tanks for slip below the floor; all of the beaters were broken off, as they had been stopped by the high feldspar content in the body, and slip had run so thin that the body had settled solid in the tanks, and the pipes were nearly closed.

"This meant plenty of worry and hard work until I got matters straightened out. Neither of the men had any knowledge of the business and came out every day grumbling and fault-finding because I could not produce goods.

"At this time (1905), the Western Art Tile Company was the only plant west of Indianapolis making tile.

"We had to send to New York for all needs. Freight alone on china clay and feldspar was $30 per ton. This was certainly tough for the pioneers.

"I had been in Tropico several months before filling our first order. I saw our engineer writing on the wall and found out afterward that he was marking the date of the first order shipped and produced from this factory during the five years it had been running.

"We received an order from a tile contractor here to supply a floor in a design calling for a green and red pattern on white. We fixed up an oak barrel on a shaft, got some flint pebbles, and used it as a ball mill to dry-grind the green and red. I found that one sample was very good and asked for more of the material. I then found out that it was an outcropping away up in the mountains. They loaded it in sacks and brought it down to the railroad on donkey backs. It proved to be a hard shale, and I used a small laboratory dry pan and ground it fine, and then ground it in an old-fashioned drag mill used for glazes and, after this grinding, dried it out. We finally finished this order, and shortly after I quit in disgust.

"This Company went out of business in 1910." (36)

Tropico Tile Company, Tropico

"The Gladding, McBean & Company purchased the West Coast Tile Company property and endeavored to make colored glazed tile. This was about 1926 and was the first attempt this Company had ever made to get into the tile business. They were trying (not very successfully) to compete with Pomona and Hermosa in making colored wall tile.

Wade Encaustic Tile Company, Vernon

"About 1912, a man by the name of Wade, who, I believe, had some experience in the tile business, started

this Company and called it the Wade Encaustic Tile Company and built a plant at 52d and Alameda Streets, Vernon, California (a suburb of Los Angeles). He attempted to manufacture a talc tile, using the usual type of periodic, bottleneck kilns, but his operations were not successful, although he sold a small amount of tile. Sometime during 1913, Mr. Wade was killed in an accident and the Company, already in bad financial condition, became practically nonoperative for several months until 1914, when the Company quit.

West Coast Tile Company, Vernon

"After the Wade Encaustic Tile Company quit, Herbert and George Pelton (brothers) organized a corporation called the West Coast Tile Company and took over the Wade plant. They immediately discarded the talc body, sent East for technical assistance, and converted the operations to a conventional two-fire clay-body type of operation and were reasonably successful.

"In 1919, the American Encaustic Tiling Company purchased this plant from the West Coast Tile Company and placed Frank Philo in charge. Operations under Mr. Philo's management were successful, and the plant expanded to more than double its original size in the next few years.

"About August, 1933, the American Encaustic Tiling Company concluded a deal with the Gladding, McBean & Company to purchase the West Coast Tile Company." (33)

Pomona Tile Manufacturing Company, Los Angeles

"This Company was originally incorporated September 4, 1923.

"At this time, Judson F. Clark was President; E. D. Westrip, Vice-President; and Paul G. Bovine, Secretary. These men, together with G. A. Lathrop and B. L. Cooper, constituted the Board of Directors.

"On May 22, 1924, Mr. Clark sold his controlling interest in the Company to R. J. Schroeder, and the Company was reorganized under the same name

"At the present time, the officers are R. J. Schroeder, President and General Manager; W. G. Johnson, Secretary and Treasurer; and Claire E. Wilson, Vice-President.

"F. H. Wilde was their Ceramic Engineer from the time the Company started until 1940, when he was retired on a pension." (28)

Mr. Wilde was with the Robertson Art Tile Company for several years. He left this Company in 1903 and went to California, and for a number of years operated a small factory of his own. He is now eighty-six years old.

This Company has nine tunnel kilns (two biscuit and seven glost). Its annual rated capacity is 5,000,000 square feet.

Proutyline Products Company, Hermosa Beach

"About 1920, an inventor named Theodore Prouty began experimenting with talc tile bodies which could be fired rapidly, and in 1922 he formed a trust called Proutyline Products Company to further this development. This trust was converted into a corporation of the same name in 1924.

"Mr. Prouty's first experiments were conducted in a small pilot plant which he had erected in the rear of his residence. About 1924, he built a commercial plant at Hermosa Beach, California, and entered the tile field on a commercial basis. He applied for a patent covering his process on March 7, 1925, and was successful in securing coverage.

"In November, 1925, negotiations which had been under way for several weeks between the Proutyline Products Company and the American Encaustic Tiling Company were concluded, and the American took over the Hermosa Beach plant and all of the patent rights as applied to tile for the sum of $1,000,000. This contract set up certain warranties as to the value of the process and patents, which had to be fulfilled under the operation of the American Encaustic Tiling Company and over a period of about six months, before the contract finally became effective. Presumably the above-mentioned warranties stood up, because title passed to the American Encaustic Tiling Company July 29, 1926 (see p. 128).

"From that date until 1933, the American Encaustic Tiling Company continued to operate two plants in this area, the Vernon plant manufacturing ceramics and clay-bodied tile and the Hermosa plant manufacturing Hermosa tile, the talc-body type of tile.

"About August, 1933, the American Encaustic Tiling Company concluded a deal with the Gladding, McBean & Company to purchase these plants." (33)

Gladding, McBean & Company, Los Angeles

"This Company was founded in Chicago on May 1, 1875. They started their factory in the little town of Lincoln in Placer County, California, because of the discovery of fire-clay deposits in this locality." (2)

Their first product was vitrified sewer pipe. In 1884, they started making terra cotta for buildings.

"And so from a clay pit in a little foothill town a great enterprise was born, its products now exhausting every conceivable shape of clay." (2)

"The foregoing is only historical, as it was not until August 1, 1933, that they were really launched in the tile industry.

"Prior to this date, the Company operated a comparatively small tile department in Glendale.

"In August, 1933, this Company purchased the West Coast Tile Company, located at Vernon, and the Hermosa Beach factory from the American Encaustic Tiling Company. They also absorbed the West Coast American Encaustic organization, including Mr. Philo, who, however, remained for only six months.

"Gladding, McBean & Company discontinued tile manufacturing operations at Vernon, sold a portion of the property, and converted the remainder into a nonmetallic minerals grinding and processing plant, which it still operates for that purpose.

"It continued the operation of the Hermosa plant for two or three years, but gradually increased the capacity of its former tile plant in connection with its Glendale plant to absorb the previous capacity of the Hermosa plant. Since that time, the Hermosa plant has only been operated as an overflow plant, and, although it is still held intact

and in operating condition, it has not been operated for approximately one year.

"When Gladding, McBean & Company bought the West Coast properties of the American Encaustic Tiling Company, it also acquired the patent rights for the Pacific Coast area. These rights were being infringed by a number of small manufacturers who had sprung up in the area, and in 1937 the American Encaustic Tiling Company, Gladding, McBean & Company, and the Pomona Tile Manufacturing Company (a licensee) brought suit against the Pacific Tile and Porcelain Company. This suit lasted about fifty-four days in court but resulted in a full and complete victory for the plaintiffs and validation of the patent, since which time all of the infringers in this area have taken, and are now operating under, licenses." (33)

The present capacity of the Glendale plant is approximately 3,500,000 square feet per annum; the capacity of its Hermosa plant is 1,500,000 square feet per annum.

General Tile Corporation, El Segundo

"Mr. Philo, after leaving the Gladding, McBean & Company in 1934, formed this Company.

"The Mosaic Tile Company of Zanesville took a financial interest in the General Tile Corporation. Its operations were successful, and upon Mr. Philo's death three or four years ago, the Mosaic Tile Company took over the ownership 100% and now operates the General Tile Corporation as a wholly owned subsidiary. It has a rated capacity of approximately 600,000 square feet per annum." (9)

Companies Organized in California Since 1930

There have been three large companies organized in California since 1930:

Markoff Mosaic Tile Corporation, Inglewood, California

This Company makes handmade tile and glazed bathroom ceramics. It has a rated capacity of 500,000 square feet annually.

Pacific Tile & Porcelain Company, Los Angeles (plant at Hynes)

This Company manufactures white wall tile and has a rated capacity of 1,500,000 square feet annually.

California Art Tile Corporation, Richmond, California

This Company manufactures faience tile and has a rated capacity of 1,000,000 square feet annually.

Canada

Although the Frontenac Floor & Wall Tile Company is not in the United States, it is a Company of which I am justly proud and of which at the present time I am Vice-President and Chairman of the Board of Directors.

I will end my history with a review of this Company.

Frontenac Floor & Wall Tile Company, Limited, Kingston, Ontario

In 1914, George Richardson, a member of the firm of James Richardson & Sons, Limited, one of the largest grain operators in Canada, conceived the idea of building a tile plant in Kingston. One reason probably was that the finest feldspar mine in Canada, the Richardson Mine, was located twenty-five miles north of Kingston. It was owned jointly by George Richardson's uncle, Senator Henry W. Richardson, and J. Clarence Richardson of Trenton, New Jersey (no relation to the Kingston Richardsons).

The Trenton Richardson became part owner in the following way: He was operating a small feldspar grinding plant in 1900, about the year the feldspar mine was opened up. He, I think, was the first in the United States to see a sample from this mine, and he immediately ordered a sample car. As soon as the car arrived in Trenton and he had looked at it, he realized that here was a feldspar different from any to be obtained in the United States, and a feldspar which was from then on to be known as Canadian Feldspar. Mr. Richardson jumped on the first train he could get going to Kingston, and on his return was the owner of a half interest in this mine.

George Richardson persuaded eighteen Kingston businessmen to subscribe for stock, and his uncle, Senator Richardson, bought a big interest in the venture. To manage and operate the plant he obtained a young man by the name of Warwick who had been with the C. Pardee Works of Perth Amboy, New Jersey. Mr. Warwick brought with him three or four men from the Pardee Works to assist him in operating the plant. In the beginning, they confined their output to ceramic mosaic floor tile.

After operating about three years, Mr. Warwick and his assistants were unable to produce a tile that the trade would accept, and the losses became so great that they had to close down the plant.

Soon after the Company got under way, George Richardson enlisted as a captain in the Canadian Army and went overseas. He was killed in the fall of 1915 leading his Company into action. Senator Henry W. Richardson died in 1917.

The stockholders later tried to obtain a buyer for the plant and equipment but were unsuccessful.

In the winter of 1919–1920, James A. Richardson, a brother of George Richardson, decided he would like to see the tile plant operating again for two reasons: (1) because his brother, George, started it, and (2) because it would be a good thing for Kingston to have another going business to give employment to the people. James Richardson was not a stockholder in the first Company. He brought the old stockholders together and made an agreement with them that if he could get the right men to operate it, he would take over the plant. He further promised the eighteen businessmen who had put their money into the original venture that he would pay them back, out of his personal profits from the business, the $18,000 they had invested. He decided to write to J. C. Richardson of Trenton for help. As "J. C." was a dear friend of mine and knew that I had left the Robertson Art Tile Company, he at once recommended me to the Kingston people. I was immediately asked to come to Kingston to talk matters over, and it did not take us long to reach an agreement. This was in March, 1920, and I agreed to be back in Kingston by April 8 to open up the plant. I brought with me from Trenton J. Frank Stevenson, who had been in charge of the machine shop of the Trent Tile Company for nearly twenty-five years.

On April 9, we held a meeting to elect officers. I had been given a good block of stock to be held in escrow until

I had made a certain profit. James Richardson's cousin, Robert, had gone fifty-fifty with James in furnishing the money to take over the plant and have the necessary working capital. The officers elected were James A. Richardson, President; Robert Richardson, Treasurer; and Everett Townsend, General Manager. Neither of the Richardsons took an active part in the business; the responsibility was solely mine.

There were only a few persons around who had worked with the old Company, so I had to build up an almost entirely new organization. I had to teach someone how to weigh up the bodies and run the sliphouse. Mr. Stevenson could help in the pressroom, but the hardest job I had was to teach someone how to set out and fire the kilns. I put up a cot in the office to have a place to sleep while this ordeal was going on.

Then I had to start out on the road to visit the tile dealers. Fortunately, the Robertson Art Tile Company tile had gained a good reputation in Canada, and that helped me out. On June 1, we made our first shipment of tile—about two months after starting up

Robert Richardson died in November, 1920.

The first carload of feldspar was obtained from Trenton, New Jersey, as no feldspar was ground in Canada. We could obtain, however, all the rock feldspar we needed within twenty-five miles of Kingston. The feldspar from Trenton cost, laid down in Kingston, $35 per ton, so we decided to build a small feldspar grinding plant and bought the machinery from the Crossley Machine Company, of Trenton. As soon as the ceramic companies in Canada found we were grinding feldspar, they wanted us to supply them with their requirements.

We could sell the finest pure crystal feldspar for $18 per ton. Then the glass people started to use feldspar and asked us to supply them. We furnished them with a No. 2 grade feldspar for $14 per ton. We then had to build a plant large enough to take care of these orders, so thus we became engaged in the feldspar grinding business.

In 1923, this heading appeared in the *Kingston Whig-Standard:* "Unexampled generosity shown by James A. Richardson. Sends local citizens checks for 25% of their original payments in Frontenac Floor & Wall Tile Company, which they regarded as worthless. Mr. Richardson had no moral or legal obligation to pay, hence his act shows high principle. Hopes to pay rest back soon." (35) He soon afterward did pay them one hundred cents on the dollar.

We produced only floor tile until 1932, when we decided to manufacture white and colored wall tile. To do this, we had to enlarge our plant and install an electric tunnel kiln.

In the winter of 1934, I told Mr. Richardson I would like to resign as Manager, as I wanted to spend my winters in Florida. I suggested he try to secure the services of my son-in-law, P. H. Swalm, who was Superintendent of the Wheeling Tile Company's plant. Before going to Wheeling in 1919, Mr. Swalm had been assistant to W. J. J. Bowman, Manager of the Trenton Fire Clay and Porcelain Company, Trenton, New Jersey.

Mr. Richardson succeeded in getting Mr. Swalm to come to Kingston, and on July 1, 1935, he arrived at our factory and took over the management. I was made Vice-President.

Soon after Mr. Swalm's arrival, we had to enlarge our plant again and buy an oil-burning tunnel kiln, which was installed by the Allied Engineering Company, Cleveland, Ohio.

James A. Richardson was elected Chancellor of Queen's University, Kingston, in 1938. A few years before, he had presented the University with a beautiful stadium, called the Richardson Stadium. In the summer of 1938, President Roosevelt visited Kingston and made a speech in this stadium, at which time he pledged the support of the United States to Canada if we were ever attacked by a foreign country. Mr. Richardson rode to and from the stadium with the President. Later in the day, Chancellor Richardson conferred on Franklin Delano Roosevelt the degree of LL.D.

Mr. Richardson died in June, 1939, at the age of fifty-eight.

When Robert Richardson died in 1920, he left his interest to his mother, the wife of the late Senator H. W. Richardson.

When Mrs. Richardson died in 1934, she left her shares in the Company equally divided between her one son, John B. Richardson, and three daughters.

After Mr. James Richardson's death, John B. Richardson was elected President; Everett Townsend, Vice-President and Chairman of the Board of Directors; J. MacLean Stephen, Secretary and Treasurer (Mr. Stephen is an accountant for James A. Richardson & Sons); and P. H. Swalm, General Manager.

Two years ago, it was necessary to again enlarge our factory and build another oil-fired tunnel kiln, as we have added to our output a line of art pottery.

We now have four periodic kilns, one electric tunnel kiln, and two oil-fired tunnel kilns. Our rated capacity is 3,000,000 square feet annually. We can also grind 10,000 tons of feldspar.

Acknowledgment

Thanks are due to the following persons and publications for information supplied:

(1) Earthenware Floor and Wall Tile Report No. 1, Second Series, Superintendent of Documents, Washington, D. C.
(2) *Bulletin of The American Ceramic Society*, July, 1937.
(3) *Bulletin of The American Ceramic Society*, October, 1937.
(4) Ceramic Trade Directory, 1935.
(5) *Bulletin of The American Ceramic Society*, October, 1938.
(6) *Bulletin of The American Ceramic Society*, June, 1939.
(7) Herman Petri, tile contractor, 228 East 36th Street, New York, N. Y.
(8) Tile Manufacturers Association, 50 East 42d Street, New York, N. Y.
(9) Roy E. Jordan, Mosaic Tile Company, Zanesville, Ohio.
(10) Louis S. Jones, Anderson, Indiana.
(11) W. E. Phillips, Olean Tile Company, Olean, New York.

(12) W. S. Berger, Cambridge Tile Manufacturing Company, Cincinnati, Ohio.
(13) J. Milton Robertson, Dedham Pottery, Dedham, Massachusetts.
(14) Kelly Davis, 119 Pershing Road, Zanesville, Ohio.
(15) D. C. Asper, Penn Tile Works Company, Aspers, Pennsylvania.
(16) W. H. Henry, 626 Macon Street, Brooklyn, New York.
(17) F. B. Slupesky, American Equipment Company, Indianapolis, Indiana.
(18) *Bulletin of The American Ceramic Society*, January, 1939.
(19) *Bulletin of The American Ceramic Society*, November, 1941.
(20) M. A. Illing, Franklin Tile Company, Lansdale, Pennsylvania.
(21) Charles H. DeVoe, Spottswood, New Jersey.
(22) August Reikosky, Newtown Tile Company, Trenton, New Jersey.
(23) Miss Jane Robinson, Trenton, New Jersey.
(24) R. L. Cawood, East Liverpool, Ohio.
(25) W. B. Cherry, 101 Park Avenue, New York, N. Y.
(26) George L. Esp, Queens Village, Long Island, New York, N. Y.
(27) Charles E. Diefenthaler, 280 Madison Avenue, New York, N. Y.
(28) Drew Schroeder, Pomona Tile Manufacturing Company, Pomona, California.
(29) F. K. Pence, University of Texas, Austin, Texas.
(30) A. W. Koch, National Sales Company, Cincinnati, Ohio.
(31) Miss Dorothy Mason, New Providence, New Jersey.
(32) *Bulletin of The American Ceramic Society*, June, 1942.
(33) F. B. Ortman, Gladding, McBean & Company, Los Angeles, California.
(34) E. K. Eskesen, Matawan Tile Company, Matawan, New Jersey.
(35) *Kingston Whig-Standard*, Kingston, Ontario, Canada.
(36) Fred H. Wilde, Glendale, California.
(37) Harvey F. Whitehead, Yardley, Pennsylvania.

APPENDIX

I do not know the exact date these companies were organized, but I feel sure that all except the first two companies started after 1920.

B. H. Lage, Incorporated, New York, N. Y.

Four periodic kilns (biscuit); white and colored floor tile; rated capacity, 1,000,000 square feet annually; President and Treasurer, A. M. M. Brown; Purchasing Agent and Superintendent, F. B. Peins; and Secretary, A. R. Brown.

Sparta Ceramic Company, East Sparta, Ohio

This Company was organized in 1919, taking over a partnership engaged in the production of clay and agricultural lime.

The first ceramic floor tile were made in 1923, since which time volume of production has expanded rapidly in a modern well-equipped factory using both round and tunnel kilns. It has four periodic kilns; two tunnel kilns; rated capacity not given; floor and wall tile; President, S. S. Fry; Vice-President and General Manager, R. M. Gray; Vice-President, A. D. Pickett; Assistant Secretary and Treasurer, E. M. Lewis; Superintendent, J. V. Halter; and Ceramic Engineer, J. D. Whitmer.

Batchelder-Wilson Company, Los Angeles, California

Six periodic kilns (biscuit); one tunnel kiln (glost); rated capacity not given; tile; Proprietor, W. E. Bockman, and General Manager, J. W. Bockman.

Carling Tile Company, Macon, Georgia

Five periodic kilns; floor and wall tile; rated capacity, 1,500,000 square feet annually; President, A. E. Hertz; General Manager and Superintendent, R. E. Lowrance; and Sales Manager, W. F. Trenary.

Cheyney Art Tile Company, Orlando, Florida

Three periodic kilns; faience tile; rated capacity, 100,000 square feet annually; President, J. Y. Cheyney, and Superintendent, C. R. Ham.

Continental Faience & Tile Company, South Milwaukee, Wisconsin

One tunnel kiln; four periodic kilns (glost); faience tile; rated capacity, 500,000 square feet annually; President and General Manager, Carl Bergmans.

Globe Tile and Porcelain Works, Incorporated, Pomona, California

Three periodic kilns (one biscuit and two glost); mosaic floor tile (white and colored, glazed and unglazed); rated capacity, 500,000 square feet annually; President, F. W. Landfried, and Secretary-Treasurer, W. L. Kirkpatrick.

Independence Tile Manufacturing Company, Independence Missouri

In January, 1920, Mr. Friderichsen left the Wheeling Tile Company, where he had been Superintendent, to go to Independence and start the Friderichsen Floor & Wall Tile Company. This plant is now being operated by the Independence Tile Manufacturing Company; its rated capacity is 2,000,000 square feet annually. It has six periodic kilns.

Kraftile Company, Niles, California

One tunnel kiln, five downdraft kilns; floor and wall tile; President and General Manager, C. W. Kraft; Superintendent, G. E. Sladek; Ceramist, J A. Churan; and Auditor, J. B. Lewis.

Merit Tile Company, Incorporated, Rockport, Indiana

Four periodic kilns (biscuit and glost); glazed floor and wall tile; rated capacity, 700,000 square feet annually; President, Salem Parker; General Manager and Purchasing Agent, J. C. Hargis; Superintendent, N. S. Barkentin; and Ceramic Engineer, George S. Barkentin (officers as listed in Ceramic Trade Directory, 1943. F. B. Slupesky was formerly General Manager and V. O. Hampton, Superintendent).

Solon & Larkin, San Jose, California

Three periodic kilns (two biscuit and one glost); glazed and decorated floor and wall tile; rated capacity, 100,000 square feet annually; partnership, Albert L. Solon and Paul G. Larkin.

ACTIVITIES OF THE SOCIETY

A FREE INDUSTRIAL ENTERPRISE CHALLENGE*
WILL CERAMIC INDUSTRIES BE PREPARED FOR CONTINUITY OF CHANGE?

By G. H. McIntyre

Are you prepared to ask for something that does not now exist? A specification, a plan, a program for the guidance of the porcelain enameling industry through and beyond these difficult times?

"The trouble with Simonds," remarked the president of a New England manufacturing company, "was that he never thought of asking for anything that the world did not already offer."

Simonds had been plant manager, and his "resignation" had been accepted, after a year's try-out. Good operating man, Simonds, but—

That "but" had been his fatal weakness. "It never occurred to him to write a specification for something that did not exist," the president complained.

This president is of the New School of industrial administration. He knows that the way to reduce production costs, shorten or simplify processes, improve quality, is to write a clear—if seemingly impossible—specification for what you want to accomplish.

William Feather once wisely observed that the reason so few of us get what we want is that we do not *know* what we want. True, but another reason, when it comes to production processes, is that many men know vaguely what they want, but never focus sharply enough to write a concrete specification. Nor have they faith that it can be filled.

There are scores of businesses whose after-the-war production operations might be simplified, shortened, made less costly, if someone in the business were to sit down and write a specification. The fact that the business may today be humming with war production is no excuse for neglecting this responsibility. As a matter of fact, it is all the more reason for getting started. For it takes time to work out research projects.

As a writer in the *Wall Street Journal* recently expressed it, "The laboratory is closer to the shipping platform than it was, but it still takes months, sometimes years, to translate ideas into products."

Meanwhile, the man who limits himself to what the world already offers is going to be left far behind when American industry goes back to peacetime production. *And so is his business.*

Almost without exception, the enamel industry has been challenged to produce a better product at not necessarily a decreased unit cost for materials but at a much lower end cost, to the manufacturer. This must be done or we shall be forever out of the major industrial league. The answer is: definite, clear-cut, peacetime planning and preparation.

There is no lack of patriotism in planning now on how the postwar shock will be absorbed by industry while at the same time all-out production is maintained to prosecute the war. At least 15,000,000 workers will be looking for new means of livelihood when our soldiers and war product workers are released by the cessation of hostilities. Unless bureaucracy is to continue control over our very existence, as has been advocated by Vice-President Wallace in the March, 1943, issue of *The American Magazine* and President Roosevelt in his message to Congress on March 10, 1943, of a modified "Beveridge Plan," industry must be prepared to "carry on."

Let us take a look at what has happened to the porcelain enamel industry during these past twenty years. The black iron stove with its enameled oven-door panel for decoration has developed into one of all porcelain enamel inside and out. The old icebox has progressed from an unsanitary and homely object of wood and zinc to a masterpiece of mechanical perfection, made of a one-piece steel body with porcelain enameled interior and exterior for the de luxe models. The entire kitchen has become a model of streamlined perfection with pots and pans of better resistance to food acids and failure from thermal and mechanical shock; acid-resisting double drainboards with cast-iron or sheet-metal sinks; wall tile; fluorescent light fixtures; mechanical dishwashers and electric cookers.

Porcelain enameled wall tile, decorative panels, bathtubs, and lavatories are used extensively in the bathrooms of homes, hospitals, and office buildings. The roofs and even the entire outer surfaces of homes have been finished in durable weather-resistant and colorful glossy or semi-mat porcelain enamel.

In the shop, manufacturing costs have been lowered and quality improved by the introduction of continuous handling of parts in process through conveyers, large multiple-burner or electric continuous furnaces, mechanical spray equipment, conveying of liquid enamel from millroom to sprayer by pipe lines, pressure spraying and mechanical dipping of one-piece stove and refrigerator bodies as large as a young piano.

The frits available to the customer have been tremendously improved in every physical respect. Ground-coat enamels no longer "fish-scale." Fish scale always reminds me of "Bill" Rice of the Pfaudler Company. Bill is one of the best in the industry, yet he testified several years ago at one of the meetings of The American Ceramic Society that early in his career he and his staff had developed a sure cure for fish scale. They incorporated a rather large quantity of fluorspar in the ground-coat frit and whenever the shop ran into fish scale they im-

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Pittsburgh, Pa., April 20, 1943 (Enamel Division). Received April 9, 1943.

mediately removed the fluorspar. This usually stopped the fish scale.

When Bill was questioned after the Meeting as to how he could stop fish scale a second time, as he had already removed the fluorspar, his reply was a classic.

"We're not damn fools. As soon as the fish-scaling was cleared up we put the fluorspar back in, in order that we could again take it out when the fish-scaling developed."

This industry is young and the men identified with its early technical growth are still active and important in it. It has been vigorous and has grown to majority economically and technically between World War I and World War II. But what is its status today? Now?

At the moment, the industry, economically speaking, is dead or practically so. World War II has cooled the porcelain enameling furnaces and frit smelters, stopped the conveyers, and silenced the ball mills in its need for steel and other essential raw materials, but the plants and their key organizations are there and very active in the production of wartime armament. They will be ready to go again on porcelain enameled products when this war is over. The demand for consumer goods that will occur when man's thoughts can again turn to peacetime affairs will be unprecedented in the annals of business.

Do you suppose that we can go back to the same state of affairs and methods of production as before—"back to normal," if you please? James B. Reston in his recently published book, Prelude to Victory, shows that it is a fallacy to believe that wars settle nothing and that it is an illusion that we are fighting to "get back to normal," that above all else, the world and civilization never goes back to its original state of affairs after a war. Charles F. Kettering, Vice-President and Director of Research of the General Motors Corporation, says, "When we re-establish ourselves after this war, we must get the idea that we cannot have a continuity of sameness, that we are going to have a continuity of change. We need to go into the new era convinced that there is one thing eternal, it is change."

The steel, and in particular, the porcelain enameling industry, will undergo numerous changes. It must face competition from plastics, light metal alloys, our own ceramics, glass and clay products and plywood.

"Plywood," did you understand me to say? It was reported in the *New York Times* of October 27, 1942, that a new type of bathtub made of plywood withstood a recent performance test by the National Bureau of Standards "fairly well." Developed as a wartime substitute for cast-iron and steel bathtubs, the five-foot-long recessed-type plywood tub was made by the M & M Ply Tub Company of Aberdeen, Washington.

A similar bathtub is being developed by another company, whereas still other types of bathtubs are being made from other less strategic materials.

Recently our Company received a letter from a glass manufacturing company stating that they are manufacturing a glass kitchen sink. How many of you have seen glass washing-machine tubs and agitators?

There is no question but what we are entering a highly competitive age between light metal alloys, plastics, and steel in contrast to the steel age through which we have just passed. With the tremendous production facilities for aluminum-magnesium alloys as well as other corrosion-resisting alloys now being developed for war purposes, steel sheets as structural material for transportation and consumer goods will face serious competition.

Lammot du Pont, Chairman of the Board of E. I. du Pont de Nemours & Company, declared in a recent address to the American fighting forces overseas that *"after the war we will have at our command in America ten, fifty, a hundred times what we had before, chiefly new materials.*

"American factories will be producing almost seven times more aluminum than in 1939 and one hundred times more magnesium, which weighs less than aluminum. We will be making almost as much rubber by chemical processes as was grown annually in all the world before the war."

Mr. Du Pont predicted that great chemical plants would stand ready to turn out new plastics, new paints, new textile fibers, new fertilizers, and a hundred and one other new materials in quantities undreamed of only a few years ago.

"Wood that won't burn, glass that won't break, window screens that contain no wire, and machine bearings that contain no metal are just a few of the things in the offing," he said.

"Better and yet cheaper homes, finer and less costly automobiles, radios, and refrigerators; more nourishing food, superior medicines—a greater abundance of almost everything that adds to the comforts and satisfaction of living—all of these will be awaiting the home-coming soldier when the war is won."

The year 1941 saw a new all-time high in the sale of consumer durable goods (refrigerators, bathtubs, ranges, etc.). Reliable and informed people estimate a deferred demand for refrigerators at the end of 1944 at four million units, or three years' production at the 1941 rate.

There are those who believe that the deficiency in residential construction caused by World War I has never been overcome and to this must be added the effects of the present cessation of building. Best authorities feel that we can and will build about one and one half million homes annually for ten years after this war. Compare this with 325,000 units built in 1937.

How does all this affect the porcelain enameling industry?

First, we must *eliminate* the fears of these "postwar ghosts"—these light metals, plastics, stainless steel, glass, and "super-dooper" organic finishes from our thinking and substitute vision and pure "guts" to tackle the job ahead.

Arthur Kudner in his article, "Beyond Victory," published in the December, 1942, *Atlantic Monthly*, expresses this thought clearly and emphatically:

"We lost our national nerve for the first time during the recent depression. We lost the horizon as well as 'the true aspect of things past.' And then we began to worship Security instead of Opportunity. We know now, if we have not always known it, that when a man or a nation sets up Security to worship, the temper is out of the mainspring. The dynamics are gone. You think about dividing wealth instead of multiplying it. You lean on government instead of needling it. Your preoccupation is with the *difficulty* instead of its *solution*.

"But you cannot successfully argue Opportunity to the

man in whose brain doom is ringing and who is worrying about his next meal. The vision of Opportunity has to clear his head before he can hear you. Then and only then will his understanding take in the truth that the greatest security to be found on earth is in the grave.

" 'Beyond Victory,' be it near or distant—perhaps, before we are through, as a vital constituent of it—we must spread and illuminate the vision of what is possible after the war. When that is done and its magic is working, the impediments and hurdles, fancied or real, the disheartening accumulation of limiting legislation and restrictions that constrain initiative, hamper the venturesome, and intimidate the bold can be stripped away.

"The primary factor, I feel, is a dauntless man. Out of a passionate belief in his idea, out of stubborn will and an unshakable conviction at his heart, such a man refuses to be put off, dissuaded, or discouraged, but drives steadily on until he has founded a business, a fortune, and a legend. Most of our great businesses and industries of today were founded by such men. Most of their collateral was character and most of their capital was faith; and so it will be of such men until the last trumpet.

"Sharpen your pencils and thump your comptometers all you will, the vision comes first."

After the vision there must be applied the attributes of "know-how," "imagineering," and "synergism," which terms describe the proper scientific approach to any problem.

"Know-how" may be defined as both the broad knowledge of scientific fundamentals and the ability properly to utilize such basic knowledge in a practical manner.

"Imagineering" is the ingenious capacity for visualizing yet-uncharted fields with full regard to established scientific and engineering principles.

"Synergism" has been described as the force that can make $2 + 2 = 5$, the ability to derive from forces working closely together, or *Co Operation*—to produce a whole greater than the sum of the parts.

Thus we have knowledge, imagination, and Co Operation as the three *essential attributes* for those who bear these responsibilities.

Next, the porcelain enameling industry must be prepared to meet this competition fully with better products and lowered costs. Our industry has forged ahead largely through the tremendous demands for mechanical home equipment. This has resulted in the mechanization of the methods of enamel application to the steel base and has forced the improvement of the enamel glass in its physical properties of whiteness (opacity), acid resistance, weathering and, broadly, lessened susceptibility to manufacturing defects. Yes, we have highly opaque acid-resisting, weather-resisting, generally workable enamels. But there has been literally nothing radically new introduced into the industry in all these years.

Do we have enamels that can be fired on light metal alloys, copper, or steel at less than 1000°F. and will they retain these excellent properties? Do we have enamels that can be applied in one white or light-colored coating on these metal bases without a so-called ground or grip coat with no loss of production standards? Who is going to tell us how to make these enamels more elastic and with greater resistance to tensile stress in order not to have that age-old complaint, "Oh, your material chips too easily"? How are we going to make it resemble baked resinous finishes in its relation to deformation with the metal base?

Let us answer by application of "know-how," "imagineering," and "synergism."

The war has taught us to study porcelain enamel coatings with a critical eye as to its value as a corrosion-resistant material. We are learning that it can replace alloys under many conditions and in many instances do a better job.

It appears that porcelain enamel (a new one developed for the purpose) under some specific conditions will outlast stainless steel many times. This relieves strategic material now and may have a wide peacetime use.

Porcelain enamel is replacing alloys and galvanizing as a material for hot-water tanks. Today it is far superior to galvanizing in its resistance to corrosion when applied to the interior surfaces of hot-water tanks.

Much thought has been given to architectural uses of porcelain enamel. The architects and public should become conscious of our product. Talk it—believe in it—improve it—use it!

Lastly, in answer to this challenge to our industry, research and development must engage our efforts.

I have indicated a few solutions to these problems. You can name many more, as for example:

Adding to our woefully lacking fundamental knowledge of silicate reactions at high temperature.

Must the enamel be milled with water—why not an organic liquid recovered by distillation and condensation? Why control the quality of the frit exactly and then add clay, even if it is "purified"?

Study the formulation with relation to such physical properties as modulus of elasticity, tensile strength, resistance to tearing, sagging, orange peel, and chipping.

The industry is looking for cheaper raw materials, better uniformity, and improved processes. The porcelain enameling companies want young technical men for control of quality and are looking for new processing ideas.

Who can successfully eliminate all the hand dipping and beading operations in the manufacture of porcelain enameled kitchenware? Who can design the light metal streamlined kitchens and bathrooms of the prefabricated homes of the future so they may be finished in the new one-coat, corrosion-, and chip-resistant enamels that will be produced? Who is going to design and engineer the process for coating the new quick-freeze home units, the kitchen laundry, and the refrigerator that won't leak cold every time the door is opened?

The answers to these questions will be found in research and continued faith in the vision of the opportunities "Beyond Victory."

Our industry must be prepared to obtain its share of the huge volume of durable goods that will be manufactured when peace comes once again. Are we to permit the ghosts to rise and become a reality? Are we to be successful in producing better products at a lower ultimate cost?

The challenge is *here*. We have *accepted*—we are *writing* the specifications—we shall *solve* the problems.

FERRO ENAMEL CORPORATION
CLEVELAND OHIO

(1943)

Ability Depends on Factual Knowledge

Breadth of Ability ⇄ Breadth of Knowledge

Recordings of Works of Men

Are Backlogs of Knowledge

The Work Tools of Men of Achievement

End Purposes of Meetings and Publications of

THE AMERICAN CERAMIC SOCIETY, INC.,

Are Exchanging and Recording of Factual Observations

By Ceramists Who Have Achieved

In This Mutual Dependency

Men of Achievement Acknowledge Their Obligation and Do Participate

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 19, 1939	1876	237	27	642	220	3002
December 20, 1940	1995	260	25	574	220	3074
December 21, 1941	2029	257	37	609	220	3152
December 21, 1942	2088	270	15	446	220	3039
January 21, 1943	2079	267	11	444	220	3021
February 21, 1943	2095	267	10	451	220	3043
March 21, 1943	1765	262	8	416	220	2671
April 21, 1943	1909	266	18	442	220	2855

NEW MEMBERS IN APRIL

Corporation

DEMUTH GLASS WORKS, INC., W. R. Schlehr (voter), Wythe Ave. and North 11th St., Brooklyn, N. Y.

Personal

BASSETT, LEON B., 41 W. University St., Alfred, N. Y.; instructor and spectrographer, Alfred University.

CORBMAN, MORRIS, Cunningham Brick Co., Thomasville, N. C.; superintendent.

GIEHLER, FRED J., Chicago Retort and Fire Brick Co., Ottawa, Ill.; superintendent.

HUPPERT, PAUL A., Colonial Hotel, 51 West 81st St., New York, N. Y.; research engineer, Bellaire Enamel Co.

JACKSON, NELOM, Paris, Tenn.; Jackson Clay Mining Co.

KADIE, CARL H., Box 5730, Bethesda, Md.; sales manager.

LEMUNYON, JAMES S., 250 Wayne St., Mansfield, Ohio; superintendent of enameling, Tappan Stove Co.

*MATTESON, GILBERT D., 14 Belleview Place, New Rochelle, N. Y.; ceramic engineer, Ward Leonard Electric Co., Mt. Vernon, N. Y.

MCKINNEY, CHARLES D., 1229 Elm St., Chattanooga, Tenn.; salesman, Ironton Fire Brick Co.

MILLIKEN, EDWARD C., 444 W. North Ave., East Palestine, Ohio; plant superintendent, National Fireproofing Corp.

PAFFORD, RAY W., 321 Neil P. Anderson Bldg., Fort Worth, Texas; general plant manager.

*RANDOLPH, LT. HALFRED F., 175 Chelsea Ave., Long Branch, N. J.

REED, ALBERT J., 5424 Fifth Ave., Pittsburgh, Pa.; ceramic engineer, Harbison-Walker Refractories Co.

REIDER, K. G., Nela Park, East Cleveland, Ohio; manager, Glass Manufacturing Department of the Lamp Department, General Electric Co.

RHEA, WALTER A., 809 S. Third St., Alpena, Mich.; research chemist, Huron Portland Cement Co.

ROWE, RICHARD S., Box 181, Templeton, Pa.; ceramic engineer, Harbison-Walker Refractories Co.

*STEVENS, ROBERT P., Chicago Retort and Fire Brick Co., 208 S. La Salle St., Chicago, Ill.; refractories engineer.

*WILLIAMS, WALTER E., 1519 Myrtle Ave., Zanesville, Ohio; ceramic engineer, Ceramic Supply Co., Crooksville, Ohio.

Student

Georgia School of Technology: FRANKLIN H. CLOUD AND JACOB GOLDBERG.

New York State College of Ceramics: DAVID M. INGHAM, FRED KAPLOWITZ, AND ROBERT W. YOUNG.

University of Saskatchewan: JAMES A. MARLOW.

* Indicates former member of The Society rejoining.

ROSTER CHANGES FOR APRIL†

Corporation

MISSISSIPPI GLASS CO., R. D. Humphreys (voter), 220 Fifth Ave., New York, N. Y. (St. Louis, Mo.).

Personal

BARGER, H. D., 1248 Creighton Ave., Dayton, Ohio (Bay Village, Ohio)

BARNETT, CHARLES W. H., 708 S. Orme St., Arlington, Va. (Floral Park, N. Y.)

BLUME, 1ST LT. ARTHUR J., Armed Forces Induction Station, Huntington, W. Va. (Cleveland, Ohio)

BRAMLETT, WILLIAM P., JR., 535½ N. 3rd Ave., Millville, N. J. (Johnstown, Pa.)

COLEMAN, ROBERT L., 2325 Fulton Ave., Davenport, Iowa (New York, N. Y.)

COUCH, EVERETT G., Charles Taylor Sons Co., Cincinnati, Ohio (Lancaster, Ohio)

EAGLE, J. EUGENE, 221 8th St., S. W., Washington, D. C. (Pittsburgh, Pa.)

EGGLESTON, MYRON M., Box 118, Perrysville, Ohio (New Castle, Pa.)

FALCAO, ERIC R., 971 Nela View Road, Cleveland, Ohio (Niles, Ohio)

GALBRAITH, ROBERT, E. I. du Pont de Nemours & Co., Inc., Electrochemicals Dept., Wilmington, Del. (Perth Amboy, N. J.)

GUNZENHAUSER, ADOLF, 617 West End Ave., New York, N. Y. (Woodbridge, N. J.)

HALDY, NORMAN L., 458 Broadway, Bedford, Ohio (Columbus, Ohio)

HELLMERS, HENRY T., 5801 63rd St., Eastpines, Riverdale, Md. (Lancaster, Ohio)

KIRSCH, ALPHONSE J., 149 Manhattan Ave., New York, N. Y. (Rochester, N. Y.)

LINTZ, E. H., Universal Potteries, Inc., Cambridge, Ohio (Berkeley, Calif.)

MONTGOMERY, E. T., Engineering Experiment Station, Ohio State Univ., Columbus, Ohio (Washington, D. C.)

NORDQUIST, DAVID F., 9 Hockeborn Ave., Auburn, N. Y. (Saugerties, N. Y.)

SCHOFIELD, H. ZANE, Battelle Memorial Institute, 505 King Ave., Columbus, Ohio (Flint, Mich.)

SCHROEDER, FRED W., Box 105, Warrenton, Mo. (Mexico, Mo.)

TERRY, JOHN H., JR., Farrhill, Westmoreland Depot, N. H. (Keene, N. H.)

† Address in parentheses is former address.

MEMBERSHIP WORKERS' RECORD

Corporation

Office	1

Personal

A. I. Andrews	1	A. F. Greaves-Walker	1
C. E. Bales	2	Ignaz Kreidl	1
W. J. Bartlett	1	Howard Petty	1
R. E. Birch	1	L. R. Whitaker	1
Office	9		

Student

R. M. Campbell	3
Lane Mitchell	2
W. G. Worcester	1
Grand Total	**25**

CERAMIC CAMERA CLUB AWARD WINNERS

Fifth Annual Salon, Pittsburgh, Pa.

Classification	Award	Exhibitor	Print title
(1) Pictorial	First	F. G. Schwalbe, Toledo, Ohio	"Still Life"
	Honorable Mention	Rolland Roup, Milwaukee, Wis	"Winter Shore"
(2) Portrait	First	J. Earl Frazier, Washington, Pa.	"Bueno"
	Honorable Mention	R. W. Knauft, Cincinnati, Ohio	"Old Ned"
(3) Industrial	First	J. Earl Frazier, Washington, Pa.	"Industrial Rhythm"
	Honorable Mention	C. L. Babcock, Toledo, Ohio	"Glass-Water and Steam"

The Chauncey E. Frazier Award was won the second consecutive time by F. G. Schwalbe.

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(167) JOHN BOROS, New York State College of Ceramics, Alfred, N. Y.
(168) HARVEY L. COHEN, Georgia School of Technology, Atlanta, Ga.
(169) A. P. GRIFFITH, Emsco Refractories Co., Los Angeles, Calif.
(170) WINGATE A. LAMBERTSON, Carnegie-Illinois Steel Corp., Chicago, Ill.
(171) DAVID F. NORDQUIST, North American Cement Corp., Catskill, N. Y.
(172) EDWIN SCHEIER, University of New Hampshire, Durham, N. H.
(173) JOHN T. SELLERS, Pyro Clay Products Co., Oak Hill, Ohio

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*.

PERSONAL NOTES

FELLOWS ELECTED APRIL 19, 1943

SANDFORD STODDARD COLE, Titanium Div., Research Lab., National Lead Co., South Amboy, N. J.
WILLIAM LOUIS FABIANIC, Owens-Illinois Glass Co., Alton, Ill.
ROBERT ANDERSON MILLER, Pittsburgh Plate Glass Co., Pittsburgh, Pa.
JACOB ELLIS ROSENBERG, O. Hommel Co., Pittsburgh, Pa.
FREDERIC WILLIAM SCHROEDER, A. P. Green Fire Brick Co., Mexico, Mo.

PHOTOGRAPH OF DR. TURNER IN COLORS*

The Society of Glass Technology, assembled at its 219th Ordinary General Meeting at the Department of Glass Technology, the University of Sheffield, on Wednesday 17th February, 1943

Having been presented with the Illuminated Greetings of the Fellows of the Society in the U.S.A. and of The American Ceramic Society in accepting the replica of the portrait of Professor Turner; and

Having heard a report from Dr. C. J. Peddle, Past-President of the Society and Chairman of the Portrait Committee,

RESOLVES,

That the Society receives the Illuminated Greetings with gratitude and records its profound pleasure and appreciation of this friendly and courteous presentation.
That the Illuminated Greetings be suitably framed and permanently displayed in an appropriate place in one of the rooms made available for the work of the Society within the Department of Glass Technology and
That the thanks of the Society be forwarded to The American Ceramic Society with salutations, together with an expression of gratification that the name and personality of Professor Turner are so closely associated with the friendly relations between the two Societies giving peculiar and special encouragement to the hope at the present time, when our two peoples are so intimately joined together, that they may be successful in the struggle to preserve their way of life and to extend the friendly association of all nations.

—S. ENGLISH, *President*

* Resolutions received April 9, 1943.
See also pp. 22 and 23, January, 1943, *Bulletin*, and p. 68, March, 1943, *Bulletin*.

H. ZANE SCHOFIELD JOINS BATTELLE STAFF

Henry Zane Schofield has been appointed to the research staff of Battelle Memorial Institute, Columbus, Ohio, and assigned to its Division of Ceramic Research.

Henry Zane Schofield

A graduate in ceramic engineering from Ohio State University, Mr. Schofield has held various engineering and production positions in the ceramic industry since 1929. Before joining the Battelle staff, he was associated with the Standard Tile Co., Zanesville, Ohio.

Mr. Schofield is a Fellow of The American Ceramic Society and a member of the Institute of Ceramic Engineers, Keramos, Tau Beta Pi, and Sigma Xi. Much of his past work has been on glazed and unglazed floor and wall tile, paving brick, and structural clay products.

33 Persons and 2 Corporations Joined The Society at The Forty-Fifth Annual Meeting

INSTITUTE OF CERAMIC ENGINEERS

President: H. B. DuBois, Consolidated Feldspar Corp., Trenton, N. J.
Vice-President: R. F. Sherwood, United Feldspar and Minerals Corp., New York, N. Y.
Secretary: Karl Schwartzwalder, A C Spark Plug Co., Flint, Mich.
Past-President: H. M. Kraner, Bethlehem Steel Co., Bethlehem, Pa.
Trustee Representative: H. G. Wolfram, Porcelain Enamel & Mfg. Co., Baltimore, Md.

WHAT THE INSTITUTE OF CERAMIC ENGINEERS HAS DONE ABOUT LICENSING

For the past two decades, strenuous efforts have been made by the outstanding members of the Founder's Societies to raise engineers to the same professional level as medical men and lawyers by requiring them to pass state examinations in order to practice. Progress was extremely slow in the beginning because of the large number of men who called themselves engineers and practiced engineering without the necessary background of formal training. These men have fought all efforts to pass the necessary state laws, with the result that there are still a few states which do not have licensing laws.

It was perfectly natural that, as the states gradually passed the necessary laws, only those branches working for their passage were specifically mentioned. These were civil, mechanical, electrical, and, in some cases, mining engineering; later laws included chemical engineering. Thus those branches of engineering such as ceramics, which had no engineering society to represent them, were left out entirely.

As the number of states passing licensing laws increased, the examining boards formed the National Council of State Boards of Engineering Examiners. This Council, growing stronger each year, began to press for strict observance of the laws, most of which prevented anyone from using the title "engineer" and doing consulting work unless he held a license. To use a slang phrase, this placed ceramic engineers, among others not mentioned in the laws, "behind the eight ball."

To obtain the recognition of ceramic engineers by the various states was not an easy matter. In all cases, it required the approval of the state boards and, in some cases, amendments to the licensing laws.

When the ceramic engineers began to realize the necessity for recognition, they found they had only one organization of engineers which could represent them before the state boards, namely, Keramos, the national professional ceramic engineering fraternity. Immediately after the reorganization of this body in 1932, its officers began planning for a campaign for recognition.

The first opportunity to drive an entering wedge came when the Ohio licensing law came before the Legislature. Ceramic engineers, as usual, were not included. Keramos, The American Ceramic Society, and the Department of Ceramic Engineering at Ohio State University cooperated in having ceramic engineers specifically included in the bill.

With the recognition of one state an accomplished fact, Keramos decided to take the matter to the National Council of State Boards in an effort to extend the list.

In 1936, A. F. Greaves-Walker was delegated by Keramos to attend the annual meeting of the Council held at Knoxville, Tenn. For the first time, all but one or two of the delegates present became acquainted with the large and important field covered by ceramic engineering. At that meeting and the two following meetings, to which Keramos also sent a representative, the boards of the following states agreed to license ceramic engineers: Alabama, Arizona, Connecticut, Florida, Oregon, Iowa, Kentucky, New York, North Carolina, and Wisconsin.

In 1939, through the effort of Keramos, the Institute of Ceramic Engineers was organized and took over the contact work with the state boards.

Educating and getting the boards to act required a great deal of effort. Bulletins explaining the field of engineering covered and the varied types of work done by ceramic engineers were distributed to them several years in succession, and personal work was continued at the annual meetings.

The requirement of the Institute that those admitted to the Member grade must have professional licenses or experience that would entitle them to one made a strong impression on members of the boards and brought from a chairman of one board the statement that "the ceramic engineers were the most professionally minded group of engineers in the country."

The assistant secretaries of the Institute, distributed throughout the country for the purpose, maintained constant contact with the state boards in their regions and did excellent service in making personal contacts. They also kept in close touch with engineering groups in a number of the states which were endeavoring to have licensing laws passed or amended and in every case succeeded in having the laws written to include ceramic engineers. Individual members of the Institute, particularly in the departments of ceramic engineering, also gave great assistance in the states in which they were located.

The list of states in which ceramic engineers could obtain licenses grew gradually year by year and as of January 1, 1943, was as follows: Alabama, Arizona, Colorado, Connecticut, Delaware, Florida, Georgia, Indiana, Iowa, Kentucky, Maryland, Michigan, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, and Wisconsin.

A licensing law passed in Illinois in 1941 goes into effect this year, under which ceramic engineers may be licensed. Massachusetts also passed a law in 1941, but it is ineffective because registration is optional.

The only important ceramic-producing states which do not now license ceramic engineers are West Virginia and California. The State Board of West Virginia has consistently refused to recognize ceramic engineers on the ground that those residing in that state are not interested in being licensed. Several of the states, notably Pennsylvania, Texas, and Indiana, withheld recognition until a ceramic engineer applied for a license. In California, only civil engineers are licensed.

There are now over 75,000 licensed engineers in the United States, and the number is growing rapidly. New York stands out as the state in which it is most difficult to obtain a license. All applicants must pass an examination which covers the fundamentals and practice of engineering, with the emphasis on construction.

With one or two exceptions, all licensing laws recently passed are duplicates of what is known as the "Model" law which covers all branches of engineering. In most states, an engineer with ten or more years of acceptable experience usually is not required to pass an examination. There is, therefore, every reason why the older group of ceramic engineers, at least, should obtain licenses. The need for a license is not so important as the fact that every license granted brings nearer the day when engineering will be recognized as on the same professional plane as medicine and law. As long as an engineer can practice without a license, that desirable status cannot be brought into being.

—Arthur F. Greaves-Walker

1046 Persons Registered at The Forty-Fifth Annual Meeting

LETTER TO INSTITUTE MEMBERS

The Institute of Ceramic Engineers was founded to promote the professional status of ceramic engineers. It has never been quite clear to some of us just what this might mean. Those who have experience and vision especially from their better vantage point saw the desirability of organization in attaining certain objectives for the profession as a whole. Improvement of our professional status can be made only as a group, and to a large degree the promotion of our professional status is purely a matter of recognition by other engineering groups and by the general public. The plan for obtaining this recognition may take any of many forms, but in the last analysis a large amount of publicity is required. Promotion must also come from within through a proper analysis of those factors which affect our rating. Initiating certain programs will advance us to higher levels. These are objectives which cannot be attained in a short period of time.

Now, almost before learning to stand alone, the Institute is confronted with the biggest job of obtaining the kind of recognition which might ordinarily be secured only through years of well-planned efforts toward that end. As never before, ceramic engineers need recognition by the public, by engineering groups, and by those directing the flow of man power into the war effort. As an industry we have had difficulty in being recognized as furnishing valuable materials going directly or indirectly into war products. We have found it difficult to keep our men in these industries. We are faced with a severe drain of men from industries and the possible elimination of ceramic schools. Our ceramic schools have been able to supply only a small portion of the actual needs of industry for ceramic engineers. The armed forces have not considered the training of our ceramic engineers as suitable to their interests or vital to industry, although certain other engineering courses have been so approved. This does not mean that these latter industries are assured of an adequate personnel or that there will be an ample supply of young engineers available for them in the near future. It still means, however, that ceramic engineers are not so well off as the others and that there will be almost no new graduates coming along. If this condition persists there will be no young ceramic engineers available for industry for a long time after the war.

This hectic year should teach us to take serious stock of many questions which have contributed to the situation. We might ask why we have not been recognized. Perhaps it is the lack of publicity over the years. We seriously need to be known beyond our own haven. As ceramics is a specialized field dealing with a branch of chemistry not at all similar to the other branches, we have isolated ourselves with our ceramic organizations and publications more completely than most other engineers have done. Discuss publicity with a majority of our membership; suggestions obtained will generally include approaches only to ceramic periodicals. This is not the type of publicity we need. We should formulate means whereby the true breadth of our activities are known. This cannot be done within a year or two years, or perhaps, even ten years, except by a strong, well-organized, and systematic campaign beginning now. My contact with the problem in this one year has at least given me a better picture of the situation than I previously had opportunity to gain. I hope my views expressed herewith bear fruit.

The public has only a vague notion of what a ceramic engineer is and today, in dealing with draft boards, commissions, and committees who, in a sense, are just more "general public," there is every indication that we must come out of our shell. Even our technical friends in other fields may have only a vague notion of our utility. So long as we remain in seclusion we shall continue to be regarded somewhat as craftsmen, for ceramics is popularly known to include nothing beyond art pottery.

There are two kinds of publicity in which we must indulge. One type is to make contacts with other engineering groups for the purpose of making comparisons. The other is to familiarize our membership with the detailed purposes of the Institute and the results, if any, that are obtained through our contacts. This plan has been started through a series of articles by A. F. Greaves-Walker. An article carefully outlining the details about E.C.P.D. has already been published in our page in *The Bulletin* for November (p. 295) and another on S.B.E.E. appears in this issue on p. 159. These articles are directed largely toward informing our members of how our contacts are maturing into something of benefit to us along the lines proposed and in general to broaden the general view of our position in the engineering picture. Some of our members may expect rather concrete personal benefits to accrue to them from membership in the Institute. It is hoped that the broader view can be appreciated, for we all know that as a unit much can be done that would ordinarily fail without being organized as we are.

It is a narrow-minded view to expect personal benefits to accrue from our membership in an organization which pools its interests, brings information of the favorable and unfavorable sorts to its members so that advantage can be made of the former and action can be taken on the latter. One member has expressed a view in which it is hoped more of our profession will join. His words were, "If my two dollars a year means a well-recognized group after I'm gone, I would consider it money well spent." This is the proper spirit and it is hoped that we shall get more members of this caliber.

We shall have to do more toward getting our activities to dovetail with those of other engineering societies so that they also shall know who we are, what we are doing, and what ceramic engineering education embodies. This must be done by representation in outside engineering fields.

Most of our schools are now accredited by E.C.P.D., which means that we are recognized as engineers. One or two of our schools have only recently been so approved. It was not without difficulty that several others were approved. This does not indicate that our ceramic schools are not providing suitable ceramic education, but it may indicate that in the eyes of the authorities in other engineering fields we are not so well equipped in scientific fundamentals as are other engineers. Although it is my own personal opinion that any ceramic engineer would be more productive in any field of ceramics, whether it be production of any ceramic product or in research, with a more thorough training in mathematics, physics, and chemistry and less descriptive courses than are now taught. These comments are being made only insofar as they may tend to explain the light in which we are regarded by other engineering groups.

It is believed by some that the term "ceramics" as applied to our profession is a relic which has little or no sales value. The general public knows this term only in its popular use. It has therefore been suggested that we might change the name of our associations, so that the terms used shall have a broader meaning. To change the name of our groups and the name of our profession may seem awkward, but our interests go beyond the term implied by ceramics and now cover such a wide field of mineralogical chemistry that we might justly call ourselves by more meaningful terms as "Engineers of Mineral Chemistry" or "Mineral Processing Engineers" or some other suitable name which could be devised. Several men have suggested that we might gain more adequate recognition by associating ourselves with the American Chemical Society as a division, or with the A.I.M.M.E. Both of these ideas may have merit but they are not being proposed here for serious consideration at this time for it is realized that a forty-year background of ceramic engineering may be a tough hurdle to clear.

It is proposed, however, that the Institute's Committee on Status of Ceramic Engineers establish four (4) subcommittees whose efforts are publicity in behalf of our status along the following lines: (*a*) a subcommittee which would direct its effort toward written publicity, for example, articles on various branches of ceramics in other than ceramic publications and of a popular nature;

(*b*) a subcommittee which would direct its effort to publicity in engineering fields other than ceramics by papers, committee contacts, etc.; (*c*) a subcommittee which would arrange for our sending delegates to all engineering conclaves where matters of broad engineering interests are discussed; and (*d*) a subcommittee which would direct its attention toward informing our membership of developments affecting them both favorably and unfavorably.

It is further proposed that these committees be made continuing wherein terms of office in each committee would overlap.

It is further proposed that the Education Committee, in cooperation with the preceding committees, make an annual survey of representative engineering courses, including ceramics, for comparison with existing ceramic engineering courses for the purpose of keeping ceramic engineering curricula on a high plane.

—H. M. KRANER, *Past-President (1942–1943)*

LOCAL SECTIONS

BALTIMORE-WASHINGTON SECTION

The Baltimore-Washington Section met April 3, 1943, at the Arts Club in Washington, D. C. Forty-six members were present, in spite of the restrictions imposed by food rationing, which made it necessary to restrict the meeting to members only.

Officers for 1943–1944 were elected as follows:

Councillor: KENNETH M. SMITH, Severn Clay Co., Baltimore, Md.

Chairman: DWIGHT G. MOORE, National Bureau of Standards, Washington, D. C.

Vice-Chairman: W. R. LESTER, Maryland Glass Corp., Baltimore, Md.

Secretary-Treasurer: JOSEPH C. RICHMOND, National Bureau of Standards, Washington, D. C.

The speaker of the evening, Frederick R. Matson, formerly curator of ceramics at the University of Michigan Museum of Anthropology and now employed at the National Bureau of Standards, gave an interesting and informative lecture on ancient ceramics of the Near East and their survival in present-day methods of making brick and pottery in those regions. Dr. Matson gave many examples of the application of ceramic technology to archaeological problems. The lecture was illustrated by slides taken from photographs made by Dr. Matson on an archaeological expedition to the Near East.

—JOSEPH C. RICHMOND, *Secretary*

SOUTHERN CALIFORNIA SECTION

A meeting of the Southern California Section was held March 19, 1943, at Carl's Restaurant in Los Angeles, Calif. Owing to transportation problems, we had a small attendance of forty-five members and friends. We were fortunate in having Commander B. M. Burchfiel present at our meeting, and, as usual, he received a hearty welcome.

The speaker for the evening was Walter Sparks, who gave an interesting talk on the history and development of colonial ceramics. He illustrated his lecture with some fine specimens of Early American ceramics, including roof tile, building tile, and opalescent beads which were obtained mostly from Virginia.

The following officers were elected for 1943–1944:

Chairman: RALPH H. MARTIN, Vernon Kilns, Los Angeles, Calif.

Vice-Chairman: R. F. EVANS, Gladding, McBean & Co., Los Angeles, Calif.

Secretary-Treasurer: WILLIAM O. BRANDT, Gladding, McBean & Co., Los Angeles, Calif.

—R. F. EVANS, *Vice-Chairman*

NECROLOGY

ALBERT BECKER PECK

Albert Becker Peck, professor of mineralogy at the University of Michigan, Ann Arbor, Mich., died February 13, 1943.

Biography

Albert B. Peck was born in Syracuse, N. Y., September 19, 1892, the son of Henry Allen and Kitty Becker Peck. He attended grade and high schools in Syracuse and was graduated from Syracuse University in 1914 with the A.B. degree. He secured his M.A. degree from the University of Michigan in 1915 and his Ph.D. degree from the same school in 1925.

From 1914 to 1917, Dr. Peck was assistant and instructor in mineralogy at the University of Michigan. From 1917 to 1920, he was assistant and associate physicist (qualified in petrography) at the National Bureau of Standards in Pittsburgh, Pa., and Washington, D. C., where he was in charge of petrographic investigations in the Ceramic and Cement Divisions.

In 1920, Dr. Peck became assistant professor and in 1927 associate professor of mineralogy at the University of Michigan and held this position until 1942, when he became professor of mineralogy, the post he held at the time of his death.

Dr. Peck had been a consulting petrographer in ceramic investigations since 1920 for the Champion Spark Plug Co., Detroit, Mich.; since 1923, for the Libbey-Owens Sheet Glass Co. and Libbey Glass Co., Toledo, Ohio; and since 1928, for the Sterling Grinding Wheel Co., Tiffin, Ohio.

He was associated with (1) the development of special porcelains and refractories, (2) the elimination of the causes of glass stones, and (3) the mineralogical constitution and microstructure of grinding-wheel bonds.

Society Affiliations

Dr. Peck became an Active Member of The American Ceramic Society in 1921 and a member of the Fellowship in 1931. He was affiliated with the White Wares and Refractories Divisions and was Chairman of the Detroit Local Section from 1923 to 1925. He was also a Charter Fellow of the Mineralogical Society of America and served as treasurer of this society from 1920 to 1923 and 1929 to 1930 and as secretary in 1933–1934.

Publications in the Field of Ceramics

(1) Discussion of "Possible Cause for Dielectric Failure of Porcelains Apparently Free from Mechanical

Defects" by C. C. Treischel, *Jour. Amer. Ceram. Soc.*, **2** [2] 97–98 (1919).

(2) "Effect of Time and Temperature on Microstructure of Porcelain," *ibid.*, [3] 175–94.

(3) "Applications of Polarizing Microscope in Ceramics," *ibid.*, [9] 695–707.

(4) "Note on Andalusite from California, a New Use and Some Thermal Properties," *Amer. Mineralogist*, **9**, 123–29 (1924).

(5) Discussion of "Some Fundamental Principles Governing Corrosion of a Fire-Clay Refractory by Glass" by R. B. Sosman, *Jour. Amer. Ceram. Soc.*, **8** [4] 203–204 (1925).

Albert Becker Peck

(6) "Changes in Constitution and Microstructure of Andalusite, Cyanite, and Sillimanite at High Temperatures and Their Significance in Industrial Practice," *ibid.*, [7] 407–29.

(7) (With F. H. Riddle) "An Eighteen Months' High-Temperature Test on Refractory Test Specimens," *ibid.*, **9** [1] 1–22 (1926).

(8) "A New Glass Stone: $Na_2O \cdot 3CaO \cdot 6SiO_2$," *ibid.*, [6] 351–53.

(9) "Dumortierite as a Commercial Mineral," *Amer. Mineralogist*, **11** [4] 96–101 (1926).

(10) "Time Factor in the Formation of Some Artificial Minerals," *Jour. Geol.*, **34**, 65–70 (1926).

(11) "Role of the Ceramic Petrographer" (editorial), *Bull. Amer. Ceram. Soc.*, **6** [10] 297–305 (1927).

(12) "Symposium on Physical Chemistry of the Alumina-Silica Refractories: V, Behavior of Unstable or Monotropic Forms in the System Alumina–Silica and Related Systems," *Jour. Amer. Ceram. Soc.*, **16** [1] 68–75 (1933).

(13) (With K. Kammermeyer) "High-Temperature Preparation and Optical Properties of Sodium Aluminate," *ibid.*, [8] 363–66.

(14) (With F. H. Riddle) "Effect of Repeated Firing on Specific Gravity and Microstructure of Some Aluminum-Silicate Minerals," *ibid.*, **18** [7] 193–98 (1935).

(15) (With C. B. Slawson) "Determination of Refractive Indices of Minerals by the Immersion Method," *Amer. Mineralogist*, **21** [8] 523–28 (1936).

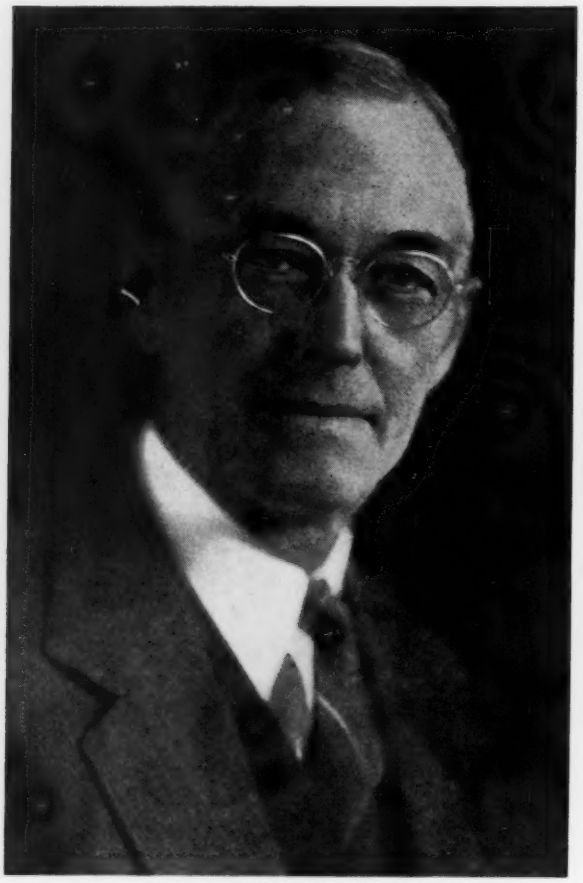
(16) (With G. T. Faust) "Refractive Indices of Some Glasses in the Ternary System $K_2O \cdot 4SiO_2$–Fe_2O_3–SiO_2," *Jour. Amer. Ceram. Soc.*, **21** [9] 320–24 (1938).

Dr. Peck was also the author of five articles on mineralogy.

WILLIAM M. WEIGEL

William M. Weigel, mineral technologist for the Missouri Pacific Railroad, St. Louis, Mo., died March 26, 1943, following a short illness.

Mr. Weigel was born at Montrose, Ill., April 7, 1878. While he was an infant, his family moved to Indiana, where he received his public school education.



William M. Weigel

His technical education was received at the Missouri School of Mines and Metallurgy, Rolla, Mo., where he was graduated with a B.S. degree in 1900 and an E.M. degree three years later. On the completion of his technical courses at Rolla, he started to work as a chemist for the St. Louis Smelting & Refining Works, Collinsville,

Ill., where he advanced to the positions of assistant superintendent and superintendent in four years.

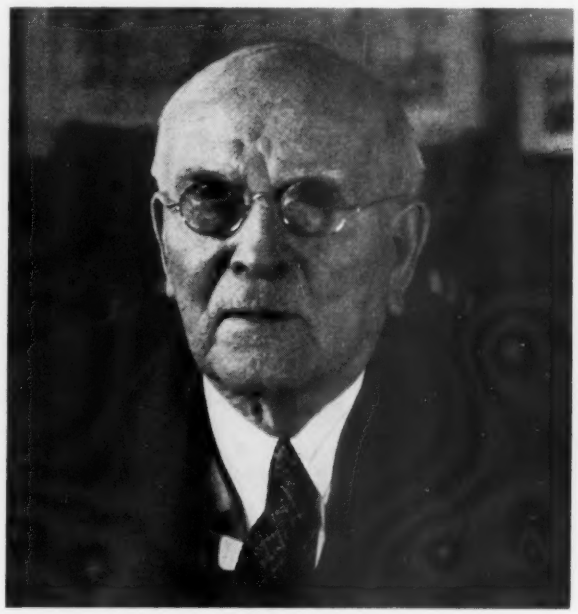
From 1906 to 1918, he was employed as superintendent of lead, cobalt-silver, and molybdenum mines and reduction plants by M. J. O'Brien, Ltd., Ontario, Canada, and as assistant and associate professor of mining and ore dressing at the Pennsylvania State College, State College, Pa. He went from this position to the Missouri Cobalt Co., Fredericktown, Mo., where he spent three years as superintendent of their smelter.

In 1921, he entered the service of the U. S. Bureau of Mines, Washington, D. C., as mineral technologist, where he remained until August, 1926, when he left to accept the position as mineral technologist of the Missouri Pacific Railroad at St. Louis, which position he held at the time of his death.

Mr. Weigel was a member of The American Ceramic Society, the American Institute of Mining and Metallurgical Engineers, and the American Chemical Society, in which organizations he played an active part by serving on various committees and holding several offices. He had served The American Ceramic Society as a member of its Committee on Geological Surveys from 1937 to 1942. Mr. Weigel also wrote several outstanding technical papers for the U. S. Bureau of Mines.

FRANK CLAYTON BALL*

Frank Clayton Ball, president of the Ball Brothers Company, Muncie, Ind., died March 19, in his eighty-sixth year, at his home on the White River after a short illness. Ball Brothers Company is the leading manufacturer of Mason jars for home canning and is now engaged in war work in a number of departments.



Frank Clayton Ball

Mr. Ball's death leaves only one brother, George A. Ball, of the original five who went to Muncie in 1886 to establish a factory for the manufacture of Ball-Mason glass jars. In 1883, when a patent held by John L. Mason expired, the Balls then living in Buffalo began to make the jars. They moved their factory to Muncie shortly after because of the cheaper fuel of natural gas. The output of their company increased by leaps and bounds, when Frank Ball invented a pressing and blowing machine in 1898 which produced jars of better quality and in greater quantity.

Mr. Ball was born in Greensburg, Ohio, the fifth child of Lucius Stiles and Maria Polly Bingham Ball. There were eight children in the family, two girls and six boys. One brother died in infancy, and three of the other five, Lucius L., William C., and Edmund Burke, have died in Muncie during the last twenty-five years.

With his brother, Edmund Burke Ball, Frank Clayton Ball started the manufacture of fish kits, small tubs for packing salt fish, in Buffalo, N. Y., in 1876. After a fire had swept away their first plant, they began to manufacture cans to contain oil. Finding that their worst competition came from glass oil cans with metal jackets, they became interested in glass and built a small glass furnace and added the manufacture of Mason jars to their small business. The brothers then began to look for a site which would provide a cheaper fuel and reduce their operating costs. Muncie, Ind., was finally chosen and they moved their factory there.

Since then, the fortunes of the Ball family have increased and their manufacturing interests have spread to include railroads, sheet-metal works, paper mills, and other glass factories.

Frank Ball was president of the Muncie & Western Railroad Company and a director of the Federal Reserve Bank and the Borg-Warner Corporation of Chicago. He was a member of the Board of Trustees of the Ball State Teachers College; Indiana State Teachers College, Terre Haute, Ind.; and Keuka College, Keuka Park, N. Y. He was well known for his many benefactions, especially to hospitals and educational institutions.

Mr. Ball is survived by his widow, one son, three daughters, and his brother, George A. Ball.

* From *Glass Industry*, **24** [4] 165 (1943).

NOTES FOR CERAMISTS

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

Tenth Annual Report Issued

Interesting and useful reference material on what engineers are doing in selecting and training new personnel for the profession and in elevating the status of engineers in general is contained in the tenth annual report which has been issued by the Engineers' Council for Professional Development. This Council is a joint agency of the professional societies of civil, mechanical, electrical, and mining and metallurgical engineers (known as the four Founder Societies), and of the chemical engineers, the engineering educators, the state licensing boards, and the Engineering Institute of Canada. The principal reports presented at the tenth annual meeting of E.C.P.D. held in New York are assembled in this report.

Engineering curricula approved by E.C.P.D. as of October 18, 1942, are also listed. Curricula so accredited are those which functioned before the recently announced Army and Navy college training programs became operative. Five hundred and fifty-one curricula, at one hundred and thirty-one institutions, are currently on the approved list. Several other curricula, such as aeronautical and industrial engineering, are listed as options of the regular courses in some of the older curricula.

Robert E. Doherty, E.C.P.D. Chairman and President of the Carnegie Institute of Technology, Cambridge, Mass., reviews activities of the year and the Council's functions in relation to present world conditions and refers to the work of the several committees. He especially refers to the E.C.P.D. conference held in September to discuss the problems of engineering man power. Representatives of (1) several government agencies which advise the War

Manpower Commission regarding the reserves of professional and scientific men and (2) a number of war industries employing large numbers of engineers attended the conference. A resolution was forwarded to the War Manpower Commission urging a more efficient use of available engineers and suggesting means for increasing their number.

The Committee on Student Selection and Guidance (R. L. Sackett, Chairman) reports continuing assistance in the guidance of high-school students to a better understanding of the engineering field and summarizes the findings of its study of tests and aptitudes of both arts and engineering students, as carried out in representative universities and high schools during 1942.

The Committee on Professional Training (Everett S. Lee, Chairman) emphasizes a new project, a manual for junior engineers, which is being prepared. The Committee on Professional Recognition (Charles F. Scott, Chairman) reports activity in its program of stressing the professional phases of the engineer's life. To this end, over 10,000 copies of an address by W. E. Wickenden, president of the Case School of Applied Science, Cleveland, Ohio, have been sold, and the Committee has been instrumental in its reprinting by several engineering society journals.

"Canons of Engineering Ethics" have been proposed by the Committee on Principles of Engineering Ethics (D. C. Jackson, Chairman) and are printed in the report. This attempt to formulate ethical standards for engineers in a written code follows similar codification of principles by other professional groups. These canons have been referred to the boards of the constituent organizations for suggestions or acceptance.

Reports by representatives of the eight constituent societies included in E.C.P.D. are included in the report, and an account of the Council's annual dinner contains a tribute to R. L. Sackett, emeritus dean of engineering at the Pennsylvania State College, State College, Pa., who is retiring from the chairmanship of the Committee on Student Selection and Guidance after ten years' service on this Committee.

G. H. SPENCER-STRONG APPOINTED PEMCO RESEARCH DIRECTOR

George H. Spencer-Strong has been appointed Director of Research of the Porcelain Enamel & Mfg. Co., Baltimore, Md. He succeeds Lyman C. Athy, who has resigned to accept the position of Vice-President of the International Products Corporation.

WOMAN VS. MAN FACTORY WORKER

Various attempts have been made to rate woman's general strength as compared with man's general strength. The Women's Bureau has found that women in general have about one-half the average man's lifting strength and about two-thirds of the average man's pulling strength. The National Association of Manufacturers has concluded that the ratio of muscular strength between men and women is 29 to 18 by weight, i.e., a woman weighing 125 lb. is only 62% as strong as a man of the same weight; the average woman's body is about 35% muscle as compared with the average man's 41%.

Experience indicates that, in general, women are better producers on monotonous jobs than men. In the wiring of airplane instrument panels, women are 50 to 100% faster workers than men.

A recent check-up of industries in Cleveland, Ohio, by the Committee on Industrial Welfare of the Chamber of Commerce reveals that the output of women and girls exceeds that of the men and boys on the same jobs in 25% of the war plants.

Another survey in the metal industries finds 64% of the production managers reporting that the output of women is better than that of men. An independent report of the National Industrial Conference Board confirms this report by showing that women's output is equaling or bettering the men's output in two-thirds of the factories.

The United States Bureau of Employment Security has surveyed several California plants and has found in each plant a production-hour increase and a lowering of unit costs after the introduction of women workers.

COPPER SCRAP SHORTAGE ACUTE

The United States depends upon scrap as the source of approximately 40% of its copper. Much of this scrap can be used by remelting without further refining. Copper wire is almost pure and can be used in place of virgin copper. The flow of this almost pure scrap, known as No. 1 and No. 2 grades, is diminishing so rapidly that the gap must be filled by other less pure grades which must be refined before they can be used.

Even greater shortages are being felt in these "less pure" grades which require refining and which are termed as "refinery brass" and "copper-bearing" materials. In appealing to industry for additional copper, brass, and bronze scrap, WPB emphasizes that in December, 1942, scrap refineries received only 4800 tons of these grades—*not enough to enable them to operate at one-fifth of their capacity.*

Not only are we seriously short of all grades of copper, brass, and bronze scrap, but the output of mined ores cannot meet demands because of man-power shortages. As in steel, the use of scrap makes possible speedier production as well as man-power and transportation savings.

To ease the scrap shortage, the Salvage Division, WPB, is appealing to industry to make up a forecast deficit of 625,000 tons of refinery brass and copper-bearing materials in 1943. This amounts to approximately 52,000 tons a month more than the 1,000,000 tons collected in 1942.

This, therefore, is the goal WPB hopes industry will achieve in 1943: A 62½% increase in the flow of copper, brass, and bronze scrap, which will result in capacity operations of the nation's scrap copper refineries.

BORAX
and
BORIC ACID
99½-100% PURE
NITRATE OF POTASH
CAUSTIC SODA
SULPHUR
Stauffer
STAUFFER CHEMICAL CO.
420 Lexington Avenue, New York, N. Y. 624 California Street, San Francisco, Cal.
444 Lake Shore Drive, Chicago, Illinois 550 South Flower Street, Los Angeles, Cal.

CERAMIC SOCIETY OF THE SOUTHWEST*

The second meeting of the Ceramic Society of the Southwest was held March 20, 1943, at the Worth Hotel, Fort Worth, Texas. Forty persons were in attendance.

The following program was presented:

Morning Session

(1) "How to Figure Brickyard Costs" by FRANK MAHURIN, Reliance Clay Products Co., Mineral Wells, Texas (questions and discussion).

(2) "Drying Troubles": Discussions by T. J. ORRENDER, Garrison Brick Co., Garrison, Texas; R. L. NORDMEYER, Valley Brick & Tile Co., Mission, Texas; and JOHN H. GRADY, Malvern Brick & Tile Co., Malvern, Ark.

(3) "Bentonite in Texas Clays: Its Physicochemical Properties and Methods of Control" by CARL FURGASON, University of Texas, Austin, Texas.

Afternoon Business Session

(1) Election of officers: All of the encumbent officers were re-elected as follows:

President: RAY W. PAFFORD, Acme Brick Co., Fort Worth, Texas.

Vice-President: FRANK MAHURIN, Reliance Clay Products Co., Mineral Wells, Texas.

Secretary-Treasurer: F. K. PENCE, Ceramics Div., University of Texas, Austin, Texas.

T. J. Orrender and R. L. Nordmeyer are also members of the Executive Committee.

A constitution was adopted which sets forth three grades of membership, viz., (1) Corporation or Supporting, (2) Personal or Controlling, and (3) Student or Associate.

(2) Question and Answer Discussion (reports from those who have tried answers which were given at the October meeting of the society (see p. 198, September, 1942, *Bulletin*)).

(3) "The Roller Extruder" by R. L. NORDMEYER, Valley Brick & Tile Co., Mission, Texas.

The next meeting of Ceramic Society of the Southwest will be held at the University of Texas, Austin, Texas, October 16, 1943.

—FORREST K. PENCE, *Secretary*

* Organized originally as the Texas Ceramic Society, June 20, 1942.

ELECTROCHEMICAL SOCIETY

Election of New President

Robert M. Burns, assistant chemical director of the Bell Telephone Laboratories, New York, N. Y., was elected president of the Electrochemical Society at a eighty-third meeting of the society held April 7–10, 1943, in Pittsburgh, Pa.

Dr. Burns was born at Longmont, near Denver, Colo., in 1890, and spent his boyhood in the western part of the state which had been recently relinquished by the Ute Indians. He attended the Colorado State University at Boulder and was graduated in 1915. For the following two years, he remained as an instructor in the Chemical Department. Graduate work in chemistry at Princeton University culminated in 1921 when he received his Ph.D. degree. In 1918, he had been commissioned Second Lieutenant in the Chemical Warfare Service and sent to France.

In 1921, Dr. Burns became a research chemist for the Barrett Company, and for a year was employed upon an investigation of the catalytic oxidation of hydrocarbons. In 1922, he joined the engineering department of the Western Electric Company, which in 1925 became the Bell Telephone Laboratories. He has been assistant chemical director of this organization since 1931.

Dr. Burns is senior author of the monograph entitled "Protective Coatings for Metals." His principal researches have been in the field of electrochemistry and corrosion. He has studied extensively the nature of corrosion reactions and their measurement by electrochemical technics and has contributed to the development of corrosion preventive methods and the evaluation of protective coatings.

Winner of Young Author's and Book Prizes

The Electrochemical Society awarded the Young Author's Prize for 1942 to Sidney Speil, Norris, Tenn., for the outstanding paper entitled "Electrophoretic Dewatering of Clay" which was presented at the Pittsburgh meeting on April 8. M. R. Thompson of the U. S. Bureau of Mines at Norris was co-author of the paper. Accompanying this cash prize was a certificate of scientific and technical books to the amount of $50. The Book Prize was established a year ago by Francis Mills Turner of New York.

Dr. Speil was born in Revere, Mass. He received his Bachelor of Science degree in physics in 1936 at the Massachusetts Institute of Technology, Cambridge, Mass. In 1937 and 1938, he was a Research Fellow in the Ceramics Laboratory and also an assistant in the summer courses in ceramics at this school. He received his Doctor of Science degree in ceramics in 1939 at M.I.T. He has been with the U. S. Bureau of Mines since 1940 and is now an associate nonmetals engineer at the Electrotechnical Laboratory, Norris, Tenn.

Dr. Speil has been a member of The American Ceramic Society since 1937.

BUREAU OF MINES ELECTRODEVELOPMENT LABORATORY

Albany, Oregon, has been selected as the site for a Northwest electrodevelopment laboratory where the U. S. Bureau of Mines metallurgists will study the recovery and processing of minerals from the Pacific Northwest as part of a program to utilize this region's vast resources in winning the war.

The buildings and grounds of the Lewis and Clark College have been purchased for conversion into a laboratory. The College holdings consist of approximately forty-five acres of ground within the city limits of Albany, three buildings with a combined floor space of about 45,000 ft., a frame cottage, and a central heating plant. Adequate electrical and gas facilities are available, and a substation of the Bonneville power administration is less than 400 yards away. There is ample room for expansion of the laboratory as the work of the Bureau progresses.

Additional advantages of the Albany site are (1) its nearness to Oregon State College, Corvallis (nine miles away), with its engineering schools, libraries, and laboratories, and (2) the fact that the existing property of the Lewis and Clark College can be converted into an electrodevelopment laboratory without using critical materials in constructing buildings and installing pipe lines, power wires, and other facilities.

ORDER OF SECRECY ISSUED TO TITANIUM ALLOY

On March 10, 1943, an order of secrecy was issued against information contained in reports Nos. 1 through 6 and 8 from the Electrical Laboratories of the Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

The order of secrecy imposes on everyone an obligation to hold confidential any information on materials, methods, and results in connection with these reports.

Any questions in this matter should be directed to the attention of D. A. Thompson, Assistant General Manager of the Titanium Alloy Manufacturing Company.

THE AMERICAN CERAMIC SOCIETY TRUSTEES AND OFFICERS FOR 1943–1944

President: C. E. Bales, Ironton Fire Brick Co., Ironton, Ohio.
Vice-President: E. H. Fritz, Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.
Treasurer: C. Forrest Tefft, The Claycraft Co., Columbus, Ohio
Secretary-Editor: R. C. Purdy, 2525 North High St., Columbus, Ohio
Past-President: L. J. Trostel, General Refractories Co., Baltimore, Md.
Past-President: J. T. Littleton, Corning Glass Works, Corning, N. Y.

TRUSTEES FROM INDUSTRIAL DIVISIONS*

Design: C. W. Read, Shenango Pottery Co., New Castle, Pa. (1946)
Enamel: R. L. Fellows, Chicago Vitreous Enamel Product Co., Cicero, Ill. (1946)
Glass: G. W. Morey, Geophysical Laboratory, Washington, D. C. (1944)
Materials and Equipment: J. E. Eagle, 221 8th St., S.W., Washington, D. C. (1945)
Refractories: J. B. Austin, U. S. Steel Corp., Kearny, N. J. (1946)
Structural Clay Products: Frederick Heath, Jr., Owens-Corning Fiberglas Corp., Toledo, Ohio (1945)
White Wares: F. P. Hall, Onondaga Pottery Co., Syracuse, N. Y. (1944)
Institute of Ceramic Engineers: H. G. Wolfram, Porcelain Enamel & Mfg. Co., Baltimore, Md. (1944)
Ceramic Educational Council: J. W. Whittemore, Virginia Polytechnic Institute, Blacksburg, Va. (1944)

* Date of expiration of term of office in parentheses.

DIVISION OFFICERS

Design
Chairman: W. A. Weldon, Locke Insulator Corp., Baltimore, Md.
Secretary: Myrtle M. French, Art Institute of Chicago, Chicago, Ill.

Enamel
Chairman: D. G. Bennett, Mellon Institute, Pittsburgh, Pa.
Secretary: D. G. Moore, National Bureau of Standards, Washington, D. C.

Glass
Chairman: J. F. Greene, Kimble Glass Co., Vineland, N. J.
Secretary: S. R. Scholes, N. Y. State College of Ceramics, Alfred, N. Y.

Materials and Equipment
Chairman: E. M. Rupp, National Engineering Co., 58 Fallis Rd., Columbus, Ohio
Secretary: J. F. Day, Donald Hagar Ceramic Materials, Zanesville, Ohio

Refractories
Chairman: C. L. Thompson, Harbison-Walker Refractories Co., Pittsburgh, Pa.
Secretary: S. M. Swain, North American Refractories Co., Cleveland, Ohio

Structural Clay Products
Chairman: L. R. Whitaker, Carolina Ceramics, Inc., Columbia, S. C.
Secretary: R. L. Stone, Dept. of Ceramic Engineering, Univ. of North Carolina, Raleigh, N. C.

White Wares
Chairman: J. R. Beam, Universal Sanitary Mfg. Co., New Castle, Pa.
Secretary: J. W. Whittemore, Virginia Polytechnic Institute, Blacksburg, Va.

OFFICERS OF THE FELLOWS

Dean: R. B. Sosman, U. S. Steel Corp., Kearny, N. J.
Secretary-Treasurer: R. M. King, Ohio State University, Columbus, Ohio

INSTITUTE OF CERAMIC ENGINEERS

President: H. B. DuBois, Consolidated Feldspar Corp., Trenton, N. J.
Vice-President: R. F. Sherwood, United Feldspar & Minerals Corp., New York, N. Y.
Secretary: Karl Schwartzwalder, A C Spark Plug Co., Flint, Mich.

CERAMIC EDUCATIONAL COUNCIL

President: R. M. Campbell, N. Y. State College of Ceramics, Alfred, N. Y.
Vice-President: C. M. Dodd, Iowa State College, Ames, Iowa
Secretary: E. C. Henry, Pennsylvania State College, State College, Pa.

LOCAL SECTIONS

Baltimore-Washington
Chairman: D. G. Moore, National Bureau of Standards, Washington, D. C.
Secretary: J. C. Richmond, National Bureau of Standards, Washington, D. C.

Central Ohio
Chairman: H. J. Orlowski, O.S.U. Engr. Expt. Sta., Columbus, Ohio
Secretary: A. C. Jackson, The Claycraft Co., Columbus, Ohio

Chicago
Chairman: Hugo Filippi, 228 N. LaSalle St., Chicago, Ill.
Secretary: J. J. Svec, Industrial Publications, Inc., 59 E. VanBuren St., Chicago, Ill.

Michigan-Northwestern Ohio
Chairman: J. F. Quirk, A C Spark Plug Co., Flint, Mich.
Secretary: W. V. Blake, Macklin Co., Jackson, Mich.

Northern California
Chairman: G. A. Page, Stockton Fire Brick Co., Pittsburg, Calif.
Secretary: B. W. Wyatt, N. Clark & Sons, Alameda, Calif.

Pacific-Northwest
President: Howard Mansur, Washington Brick & Lime Co., Spokane, Wash.
Secretary: W. P. Keith, Univ. of Washington, Seattle, Wash.

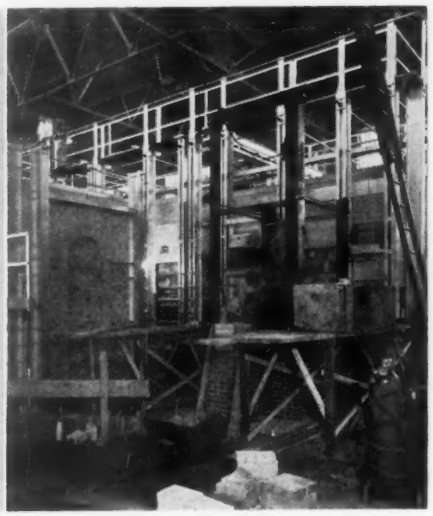
Pittsburgh
Chairman: E. E. Marbaker, Mellon Institute, Pittsburgh, Pa.
Secretary: H. E. Simpson, Mellon Institute, Pittsburgh, Pa.

Southern California
Chairman: R. H. Martin, Vernon Kilns, Los Angeles, Calif.
Secretary: W. O. Brandt, Gladding, McBean & Co., Los Angeles, Calif.

St. Louis
Chairman: H. H. Hanna, Pittsburgh Plate Glass Co., Crystal City, Mo.
Secretary: J. H. Ivery, Hydraulic Press Brick Co., St. Louis, Mo.

Follow through

PLAY SAFE



•

•

in the factory by using a SIMPLEX tank furnace with your good raw materials and SIMPLEX Blanket Batch Charger.

Excellent quantitative feeding deserves to be melted in the best tank furnace design you can buy so that you may easily and economically obtain fine quality glass.

FRAZIER-SIMPLEX, INC.

ENGINEERS

436 EAST BEAU STREET • WASHINGTON, PENNA., U.S.A.

Abrasives
Carborundum Co. (*Carborundum and Aloxite*)
Electro Refractories & Alloys Corp.
Felker Mfg. Co.
The Hommel, O., Co., Inc.
Norton Co. (*Alundum-Crystolon*)

Abrasive Wheels: (Diamond impregnated for cutting off brittle materials)
Felker Mfg. Co.

Air Conditioning Systems
Frazier-Simplex, Inc.

Aloxite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Alumina (Fused) Brick and Tile
Electro Refractories & Alloys Corp.
The Vitro Mfg. Co.

Aluminum Oxide (Calcine)
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Aluminum Oxide (Fused)
Carborundum Co.
Electro Refractories & Alloys Corp.
Foote Mineral Co.
Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bicarbonate
Du Pont de Nemours, E. I.; & Co., Inc., Electrochemicals Dept.
Solvay Sales Corp.

Ammonium Bifluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Ammonium Carbonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Antimony Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Antimony Sulphide
Foote Mineral Co.
The Hommel, O., Co., Inc.

Arches (Interlocking, Suspending, and Circular)
Frazier-Simplex, Inc.

Arsenic
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
The Hommel, O., Co., Inc.
McDanel Refractory Porcelain Co.
The Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Barium Carbonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Basic Oxides
Porcelain Enamel and Mfg. Co.

Batch Systems
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Batts
Carborundum Co. (*"Carbofrax Aloxite"*)
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Bitstone
Potters Supply Co.

Blades: (Diamond impregnated for cutting glass, tile, quartz, ceramics, Vitreous Products)
Felker Mfg. Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Body Stains
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Bone Ash
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Borax
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Borax Glass
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. (*"Carbofrax Aloxite"*)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.

Caustic Soda
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Cements
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pennsylvania Salt Mfg. Co.

Ceramic Chemicals
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Cerium Oxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.

Chromium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Ball)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.
The Vitro Mfg. Co.

Clay (Bentonite)
Foote Mineral Co.
Great Lakes Foundry Sand Co.

Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.

Clay (China)
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical Porcelain)
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Enamel)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Spinks, H. C., Clay Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Clay (Fire)
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Potters Supply Co.

Clay (German Vallendar)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemical Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.

What's YOUR Percentage of Rejections?

THE Cleveland Pottery Company, Cleveland, Ohio, is extremely well satisfied with their F-R-H De-airing machine on every count. But one of the most important factors now is that rejects are kept to a minimum, quality is greatly improved. That's why they say, "We would find it difficult to return to the conventional type of machine."

On all types of ware, under all kinds of conditions, users of F-R-H clay working machinery consistently report a higher percentage of profitable production.

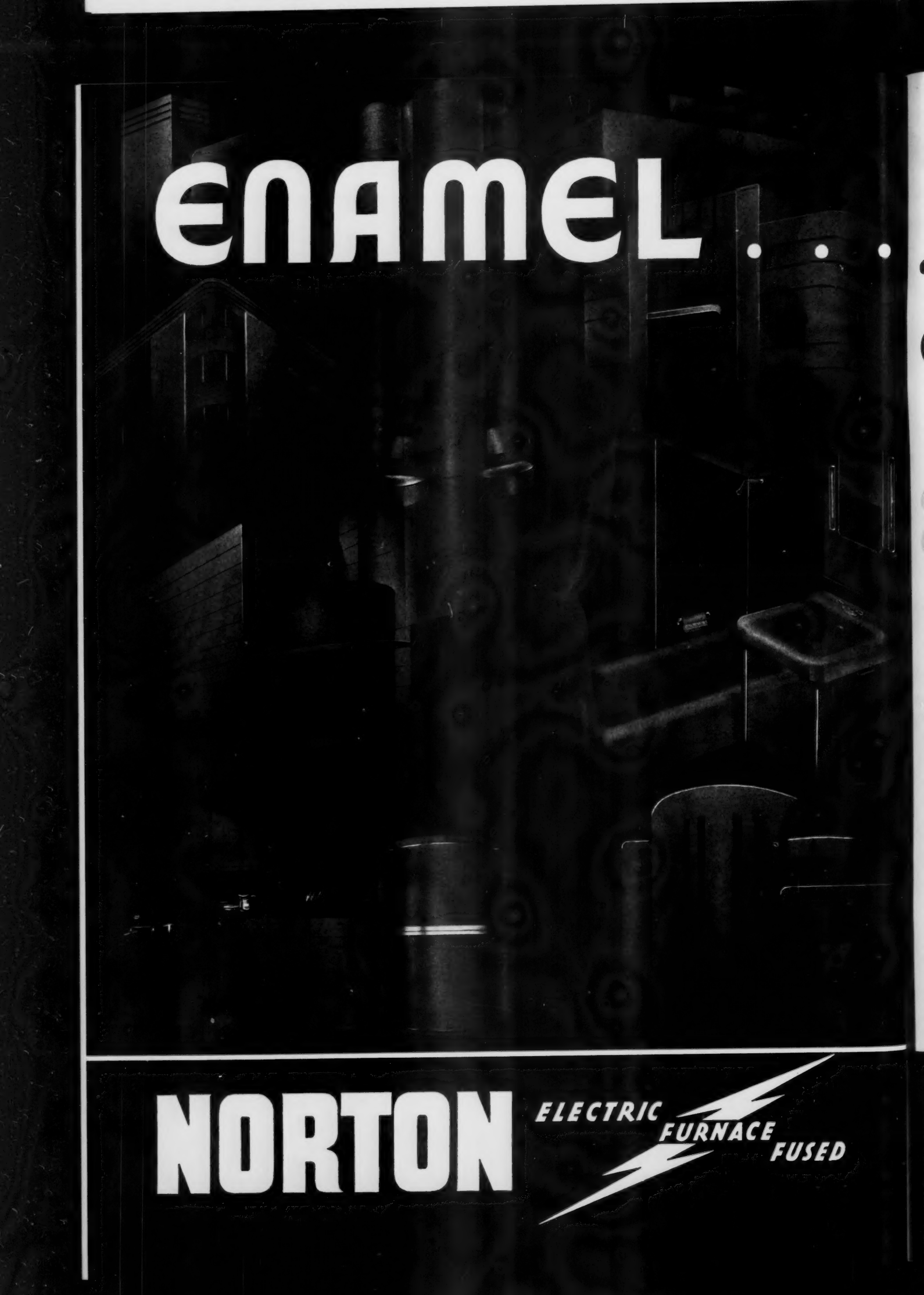
Take that into consideration when you plan for "tomorrow." In the meantime take the best possible care of your present equipment. Don't overload . . . check lubrication regularly . . . watch normal wearing parts. It will pay big dividends in the long run.

THE FATE-ROOT-HEATH COMPANY
PLYMOUTH, OHIO

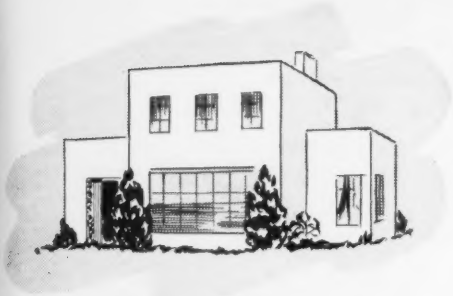
PLYMOUTH
Industrial
Locomotives

F·R·H
Clay Working Machinery

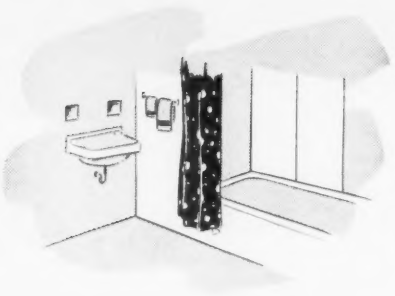
SILVER KING
Industrial
Tractors


ENAMEL . . .
NORTON
ELECTRIC FURNACE FUSED

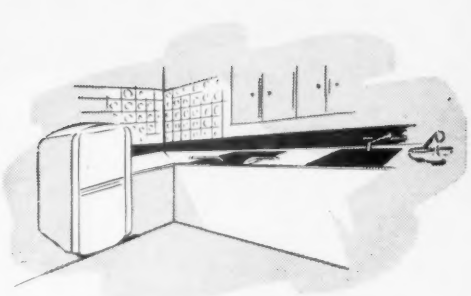
. . in the building world of *TOMORROW*



EXTERIORS



INTERIORS



FITTINGS

The possibilities of enamel are limitless, according to architects and industrial designers. In the building world of Tomorrow enamel will gain new prominence because of its possibilities for beauty and flexibility. But new structural materials (aluminum, plastics) will challenge the ingenuity of the enameling industry. *Alundum* Muffle Plates by Norton Company will help meet this challenge. *Alundum* plates will continue to be physically strong, chemically stable, and possessing high heat transfer qualities. They will continue to give longer service.

R-823

NORTON COMPANY — Worcester, Massachusetts

REFRACTORIES

Clay Miners
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Potters)
Hammill & Gillespie, Inc.
The Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Process Equipment)
Lancaster Iron Works, Inc.
National Engineering Co.

Clay (Sagger)
Great Lakes Foundry Sand Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.

Clay (Wall Tile)
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Cleaners
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
The Hommel, O., Co., Inc.

CO_2 Recorders
Leeds & Northrup Co.

Cobalt Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Colors
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Combustion Control
Leeds & Northrup Co.

Combustion Meters (CO_2 Recorders)
Leeds & Northrup Co.

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
The Edward Orton Jr., Ceramic Foundation

Controllers—Automatic Tank Pressure
Leeds & Northrup Co.

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Cutters: Diamond impregnated wheel type
Felker Mfg. Co.

Decorating Supplies
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
The Hommel, O., Co., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Enamels (Porcelain)
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
The Hommel, O., Co., Inc.

Feldspar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.

Flint
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

French Flint
Maxson, Elwyn L.

Frit
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Fuel Oil Systems and Control Stokers
Frazier-Simplex, Inc.

Furnaces
Carborundum Co. (*Carboradient*)
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Gauges, Draft (Recording, Indicating)
Leeds & Northrup Co.

Gauges, Pressure
Leeds & Northrup Co.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Goggles
The Hommel, O., Co., Inc.

Gold
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Granulators
Lancaster Iron Works, Inc.

All Types of Circular and Straight Tunnel Kilns

SWINDELL-DRESSLER CORPORATION

Post Office Box 1888 **Pittsburgh, Pa.**

Lehrs and Enameling Furnaces, Electric and Gas Fired

Full Details Furnished on Request

WANTED TO BUY

Transactions of The Ameican Ceramic Society

Volumes 2, 6, 9, 10, 12, 15, 17, 19

EMERSON P. POSTE

CONSULTING CHEMICAL ENGINEER

ANALYSES: CERAMIC RAW MATERIALS AND PRODUCTS. FUELS, IRON AND STEEL, ETC.

SPECIAL INVESTIGATIONS: PHYSICAL AND CHEMICAL TESTS ON ENAMEL, ETC.

309 McCALLIE AVE.,
CHATTANOOGA, TENN.

THE SHARP-SCHURTZ COMPANY

CHEMISTS FOR THE CERAMIC INDUSTRY

WE HAVE FULLY EQUIPPED LABORATORIES AT

LANCASTER, OHIO U. S. A.

The Best West of the Rockies

- **POTTERY CLAYS**
  English and American
- **CERAMIC COLORS**
  Blythe Colour Works, Ltd.
- **SLABS...SETTERS...SAGGERS**
  New Castle Refractories Co.
- **STANDARD PYROMETRIC CONES**
  Edward Orton, Jr., Ceramic Foundation
- **FRANTZ FERROFILTERS**
- **LAKEFIELD NEPHELINE SYENITE**
  Great Lakes Foundry Sand Co.

ELWYN L. MAXSON

Offices & Storeroom 1526 Canada Blvd., Glendale, Calif.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Norton Co. (*Crystolon*)

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hydrofluoric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Iron Chromite
Harshaw Chemical Co.

Iron (Enameling)
American Rolling Mill Co.

Iron Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Kilns, China (Decorating)
Drakenfeld, B. F., & Co.
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Kilns (Electric, Circular, Tunnel)
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Carborundum Co.
Electro Refractories & Alloys Corp.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Lithium Minerals
Foote Mineral Co.

Loaders (Bucket)
National Engineering Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.

Magnesite
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
The Hommel, O., Co., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Manganese
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Manganese (Oxide)
Corhart Refractories Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Masks (Breathing)
Drakenfeld, B. F., & Co.

Metals (Porcelain Enameling)
American Rolling Mill Co.

Micronized Products
Porcelain Enamel and Mfg. Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.

Microscopes (Stereoscopic)
Bausch & Lomb Optical Co.

Minerals
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Mixers
Clearfield Machine Co.
National Engineering Co.

Mixers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.
National Engineering Co.

Mixers (Concrete, Paving, Road Paving, Plaster, Asphalt, Truck, Mortar, Bituminous)
Lancaster Iron Works, Inc.

Mixers (Laboratory)
Lancaster Iron Works, Inc.
National Engineering Co.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace) (Laboratory)
Carborundum Co. (*Carbofrax*)
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co.

Mullers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.
National Engineering Co.

Muriatic Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nepheline Syenite
Great Lakes Foundry Sand Co.

Nickel Salts
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nitrates (Cobalt, Sodium)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Nitre
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Opacifiers
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Oxides
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Pans—Wet and Dry
Clearfield Machine Co.

Pins
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Placing Sand
Great Lakes Foundry Sand Co.

Platinum Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Polariscopes
Bausch & Lomb Optical Co.
Frazier-Simplex, Inc.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Potash (Carbonate)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.
The Vitro Mfg. Co.

Producer Glass Plants
Frazier-Simplex, Inc.

Pug Mills
Lancaster Iron Works, Inc.

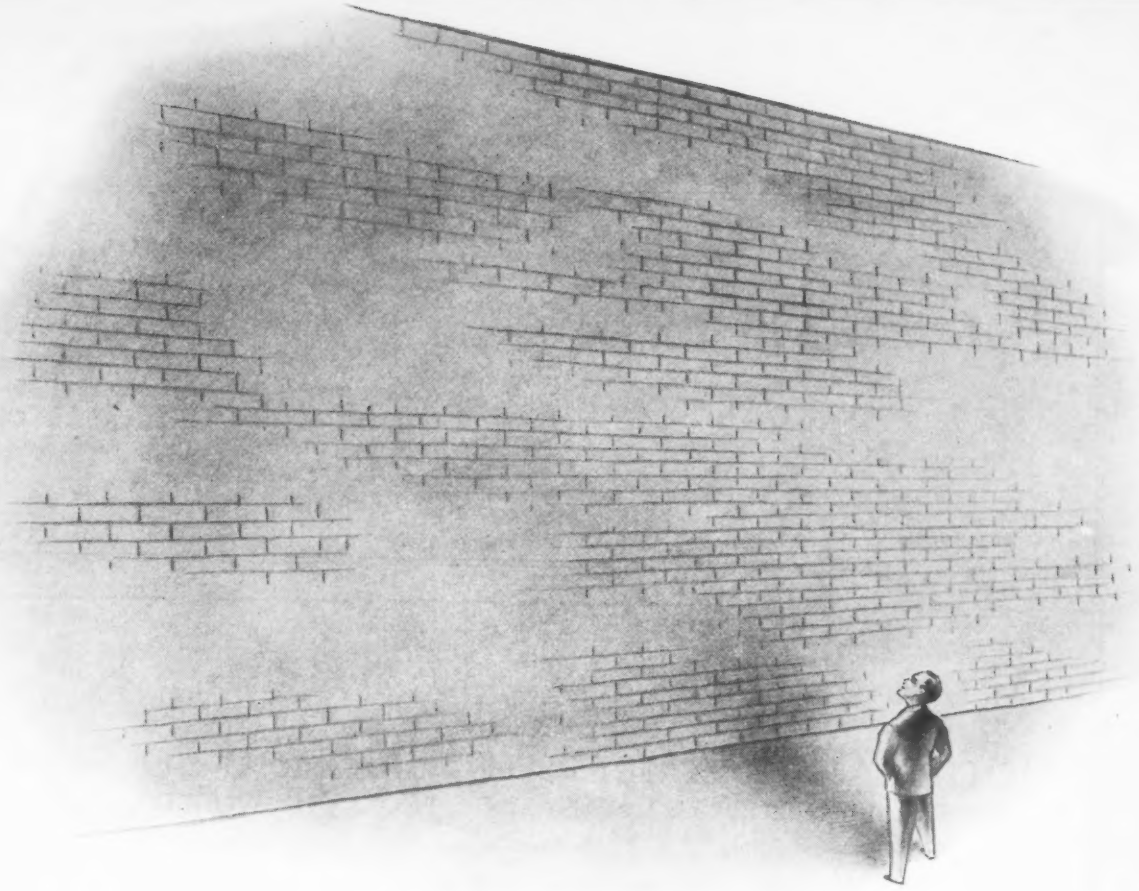
Pyrites (Natural Iron Sulphide)
Foote Mineral Co.
The Hommel, O., Co., Inc.

Pyrometer Tubes
Carborundum Co.
Leeds & Northrup Co.

Pyrometer Tubes (Refractory and Hard Porcelain)
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Norton Co.

Pyrometers (Optical, Radiation, Surface, Immersion, Needle)
Leeds & Northrup Co.

Pyrometric Cones
The Edward Orton, Jr., Ceramic Foundation



If you had to climb a wall you'd call for a ladder

OPERATING under wartime conditions, great difficulties are encountered. No need to enumerate them, they are with the ceramic industry night and day. Sometimes they are a wall — a blank, surrounding wall.

Why not call on du Pont Ceramic Service? Figuratively a ladder — certainly an important help in getting out on top.

Our research facilities and technical skill are of greatest use when they place at *your* disposal the latest results in color application . . . possible new materials to use in place of old . . . improvements in technique to meet wartime requirements.

Need assistance? Call for Technical Service. Electrochemicals Dept., E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Delaware.

DU PONT

REG. U.S. PAT. OFF.

COLORS AND DECORATIONS
for CERAMICS and GLASS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

BORAX *Guaranteed 99½%–100% Pure* **BORIC ACID**

Select the Brand which has back of it years of *successful use* by experienced Ceramists

Pacific Coast Borax Co., New York

Chicago **Los Angeles**

BACK NUMBERS
OF
JOURNAL OF AMERICAN CERAMIC SOCIETY
AND ALL IMPORTANT MAGAZINES FROM THE WORLD OVER

We furnish single copies, volumes, or sets reasonably and promptly

WRITE, PHONE OR WIRE PERIODICALS DEPARTMENT

THE H. W. WILSON COMPANY 950 University Avenue, New York

Ceramic Service? We Give It

We Manufacture–

Pins—all shapes and lengths
Stilts
Thimbles
Spurs
Saggers
Crucibles
Tile for Decorating Kilns

We Sell–

Ball Clays—Kentucky
Sagger Clays—Kentucky
Ground Fire Clay—Ohio, Pennsylvania
Bitstone—all sizes
Fire Brick
Imported Paris White
Domestic Whiting
Georgia Kaolin
Modeling Clay

THE POTTERS SUPPLY COMPANY
EAST LIVERPOOL, OHIO

Raw Material Handling Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Recorders, CO_2
Leeds & Northrup Co.

Recorders, Draft
Leeds & Northrup Co.

Recorders, Tank Pressure
Leeds & Northrup Co.

Refractometers
Bausch & Lomb Optical Co.
Electro Refractories & Alloys Corp.

Refractories
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Refractory Materials
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Titanium Alloy & Mfg. Co.

Respirators
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.

Rutile
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Sandblast Sand
Great Lakes Foundry Sand Co.

Sand Grinders and Sifters
Lancaster Iron Works, Inc.

Saponin
The Hommel, O., Co., Inc.

Saws: Diamond impregnated for cutting off
Felker Mfg. Co.

Screening and Magnetic Separators
National Engineering Co.

Selenite of Sodium
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Selenium
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel O., Co., Inc.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
Foote Mineral Co.
The Hommel, O., Co., Inc.

Silicate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Electro Refractories & Alloys Corp.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Soda Ash
American Potash & Chemical Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Silica Fluoride
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Uranate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Spray Booths
The Hommel, O., Co., Inc.

Spraying Equipment
The Hommel, O., Co., Inc.

Spurs
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Lancaster Iron Works, Inc.

Stilts
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Sulfur
Stauffer Chemical Co.

Sulfuric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Stauffer Chemical Co.

Talc
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
International Pulp Company

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Cohart Refractories Co.

Tanks (Pickle)
The Hommel, O., Co., Inc.

Tanks for Raw Material Steel or Concrete
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
Carborundum Co., (*Carbofrax*)
Electro Refractories & Alloys Corp
Norton Co.

Tin Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Drakenfeld, B. F. & Co.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Trisodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelair Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Electro Refractories & Alloys Corp.
Leeds & Northrup Co.
McDanel Refractory Porcelain Co.
Norton Co.

Uranium Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Uranium Oxide (Yellow-Orange-Black)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Whiting
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Zircon
Foote Mineral Co.
The Hommel, O., Co., Inc.

Zirconia
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Zirconium Oxide
Foote Mineral Co.
The Hommel, O., Co., Inc.
Titanium Alloy Mfg. Co.

Zirkite (Natural ZrO_2)
Foote Mineral Co.

He can smile through it all

So let's keep a smile a-going back here, too.

Even though war is crowding the wires, telephone people still want to give you pleasant, friendly service. Materials for new telephone facilities are not to be had. But there's no shortage of patience and understanding.

Takes a lot of pulling together to do this and we appreciate the help from your end of the line.

BELL TELEPHONE SYSTEM

WAR CALLS COME FIRST

• Your continued help in making only vital calls to war-busy centers is more and more essential every day.

Super quality clays

Perfect plant performance

Interest of our complete organization

No delay in shipments

Kinds of clays individually needed

Storage facilities assuring ample supply

Controlled uniformity

Laboratory tested

A low moisture content

Your profits increased

Service with a smile

Write us for samples

H. C. SPINKS CLAY COMPANY

P. O. Box 256 **Newport, Kentucky**

Our supplies of Ceramic chemicals are now available as follows:

OXIDE OF ANTIMONY

Ample quantity available for delivery, on suitable allocation, for flame proofing, decolorizing glass and as an opacifier for porcelain enamels.

SODIUM ANTIMONATE

Available for all ceramic purposes.

ZIRCONIUM SILICATE

Highly refined Zirconium Silicate—all through 325 mesh seive and finer. Ample supplies available—no restrictions.

No Tin Oxide available until further notice.

METAL & THERMIT CORPORATION
Ceramic Division

120 Broadway, New York